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SCROPHULARIACEAE OF THE WEST GULF STATES.

BY FRANCIS W. PENNELL.

This study deals with the plants of the family Scrophulariaceae occurring in the area west of the Mississippi and east of the Pecos rivers, in the states of Arkansas, Oklahoma, Louisiana and Texas. It follows closely the manner of presentation of the account of the "Scrophulariaceae of the Southeastern United States," which appeared in these Proceedings¹ in 1920, and the introduction to that paper will in most points apply to this.

To the West Gulf states I have made two collecting-trips, one in spring and one in early autumn. The latter, the first in point of time, was in 1913 through central Oklahoma, central and southeastern Texas, Louisiana, and Arkansas, and was in search of the plants herein classed in the tribe Buchnereae. Nearly every species of these genera was found and descriptions were made of the form and color of corolla and other evanescent features. This study was undertaken on behalf of the University of Pennsylvania and its results still await publication in the "Contributions from the Botanical Laboratory" of that institution. Unexpectedly therefore, a number of new species and geographic varieties will first appear on these pages.

In late April and May of 1920 I visited all of these states for early-flowering species, obtaining in chief variety species of the genera *Penstemon* and *Castilleja*. This second journey, made in the interests of the New York Botanical Garden, took me across southern Louisiana and Texas to Corpus Christi, inland through central Texas and up to the Staked Plains of the northwest, across Oklahoma from west to east, and across the Ozark Mountains and into the pineland of eastern Arkansas. Neither route need now be cited in detail, as all localities are given in the lists which, classified by counties, accompany each species. Suffice it to say for both trips, the field-descriptions obtained, and the observations of the limits of variation of each species, have been beyond

¹ Proc. Acad. Nat. Sci. Phila. 71: 224-291. 1920.

value. In this manner, group by group, should all our vast body of herbarium-conclusions be checked and re-valued in the field!

The tribe least studied in this area is the Gratioleae. These are summer-blooming and unfortunately were not included among the special objects of search of my first journey. However, only in *Gratiola* do I feel this loss, and it remains for some future worker to give us needed information of *G. gracilis* and *G. flava*. Most of the tribe but slightly enter the area from the East Gulf states and are species well-known eastward. Of other tribes, I particularly deplore not finding in blossom *Leucophyllum*, said to be one of the finest ornamental shrubs of Texas. Species of still other tribes were missed, but, while it would have been a pleasure to have seen what must be among the most showy members of their respective genera, *Penstemon murrayanus* and *Castilleja purpurea*, yet such distinct species are not in need of close analysis.

When the attempt is made to express in terms of natural areas of distribution the ranges of various species over an area such as this, one realizes how far ahead is still any comprehensive outlining of phytogeographic areas in our country. However, I have tried to use terms that have some definiteness, physiographic or geologic. In Louisiana and eastern Texas we have some preliminary sketches by Roland M. Harper², in Texas the outlines of Vernon Bailey³, W. L. Bray⁴, and R. T. Hill⁵, and in both Texas and Oklahoma excellent geological maps. In each state careful state surveys of plant and animal distribution are needed, and such tasks should call forth local enthusiasm. Mr. Bailey's study is the most accurate of those seen, and applies carefully the system of life-zones evolved by the Biological Survey. Although I am an ardent devotee of this system when applied in mountainous regions, I can but wonder what value a life-zone outline can be in such a land as Texas. Life-zones lay stress upon the one factor of temperature; in the Rockies and Andes the limits of bands of temperature-controlled vegetation are distinct enough, but surely across flat and rolling Texas the student of distribution must pay more attention to moisture and soil. However, for

² Bull. Torr. Bot. Club 47: 289-317. f. 1-5. 1920.

³ N. Am. Fauna 25: 1-222. pl. 1-16, f. 1-24. 1905.

⁴ Bull. Univ. Texas 82: 1-108. pl. 1-14, f. 1-4. 1906.

⁵ Physical Geography of the Texas Region (Topog. Atlas U. S. A., Folio 3) 1-12. f. 1-66. 1900.

species of upland Texas, following Bailey's map, I have given life-zone—but only to make as definite as possible my statement of range. Usually I have been content with other terms. Nearly everywhere through the West Gulf states, I have found collections so few and remote as to make any statement of range only a skeleton outline and a study of probabilities.

We have quite insufficient collections from the West Gulf states. Yet that there are many who have had some interest in this flora the list of collectors at the close of this article testifies. To all these collectors I feel my indebtedness; as also I am under obligations to the curators of the several herbaria, also listed herewith, who have placed at my disposal the material in their care. The Missouri Botanical Garden has undertaken a special investigation of the plant-life of the West Gulf states, and Mr. Ernest J. Palmer's work is giving us our best understanding of their flora.

In the present outline, as in the study of southeastern Scrophulariaceae, are given full keys to contrasts noted, but these made to apply only to species of the area considered. A further modification of the phylogeny of this family, one which was introduced in my study of the "Scrophulariaceae of Colombia," is to consider *Mimulus* as a tribe apart from the Gratioleae. Synonymy is now given, and the application of each name explained; again this data is only given as it pertains to native species or to species proposed from this area. Available typic and isotypic material has been studied, and the Academy's herbarium has proven rich in the types of Nuttall's and of Leavenworth's Arkansas species.

To show the basis for the summaries of distribution, and to enable others from other view-points to work with this data, I am citing for native species all localities from which specimens have been seen. These are listed by states, and alphabetically by counties, the name of the county being followed by a colon. One collection to a county is cited. The letters in parentheses following the collection-entry refer to the herbarium in which the specimen may be consulted, and their application may be found from the list of herbaria given at the end of this paper.

Corolla with the posterior lobes external in the bud.

(ANTIRRHINOIDEAE.)

Capsule septicidal or loculicidal by a simple slit, the septum breaking from the capsule-wall or rupturing. Corolla not spurred nor saccate anteriorly.

Stigma two-lipped. Inflorescence simply racemose. Leaves opposite. Herbs.

Capsule septicidal, or secondarily also somewhat loculicidal; placentae simple. Sepals distinct or nearly so. Leaves and capsule somewhat glandular-punctate.

I. GRATIOLEAE.

Capsule loculicidal (only tardily septicidal, if at all); placentae branched and widely spreading. Sepals united over one half length. Leaves and capsule not glandular-punctate.

II. MIMULEAE.

Stigma capitate. Capsule septicidal.

Leaves alternate. Plant frequently with stellate hairs.

Corolla slightly zygomorphic. Filaments all with fertile anthers. Inflorescence simply racemose.

Corolla yellow or white, rotate, its lobes much longer than the tube. Filaments five. Herbs.

III. VERBASCEAE.

Corolla rose-pink with orange markings, campanulate, its lobes shorter than the tube. Filaments four (the posterior lost). Shrub.

Leaves opposite. Plant never with stellate hairs. Corolla tubular-campanulate, zygomorphic, its lobes shorter than the tube. Filaments five, the posterior without anther, the others didynamous. Inflorescence simply racemose, or of cymose fascicles. Herbs.

V. CHELONEAE.

Capsule loculicidal, the septum and adjacent capsule-wall persisting, the remaining wall splitting irregularly. Corolla saccate or spurred at base of anterior petal. Leaves alternate. Herbs.

VI. ANTIRRHINEAE.

Corolla with the anterior lobes external in the bud. Herbs.

(RHINANTHOIDEAE.)

Stamens two, the postero-laterals present, the antero-laterals completely lost. Antero-lateral lobes of corolla external in bud. Not parasitic. Sepals four, the posterior lost. Posterior lobes of corolla completely united. Capsule loculicidal.

VII. VERONICEAE.

Stamens four, didynamous, the antero-laterals usually slightly the longer. Usually, perhaps always, parasitic on the roots of other plants.

Sepals five, alike, more or less united. Corolla-lobes all somewhat distinct, the two posterior spreading or arched or flattened; anterior lobe external in the bud. Capsule loculicidal.

VIII. BUCHNERAE.

Posterior sepal shorter or wanting. Corolla decidedly two-lipped, the posterior lobes united and arched nearly to apex, the anterior lobes shorter; anterior or one antero-lateral lobe external in the bud. Capsule septicidal or loculicidal.

IX. RHINANTHEAE.

1. GRATIOLEAE.

Leaves entire to serrate. Seeds brown or yellow.

Corolla with the ridges to the antero-lateral sinuses low and not projecting beyond those points (so anterior filaments simple). Posterior lobes of the corolla little shorter than the anterior. Seeds reticulate or longitudinally striate. Pedicels frequently bibracteolate.

Anther-sacs proximate, no connective arms developed.

Seeds reticulate. Leaves not cordate clasping at base.

Pedicels bibracteolate (or in *Gratiola* the bractlets sometimes several, one or wanting). Leaves pinnately veined (except in *Hydrotrida*). Styles united throughout. Sepals five, acute or obtuse.

Pedicels bracted at base (remote from the calyx).

Corolla yellow or white, pubescent within at base of posterior lobes. Stamens four. Sepals unequal, and leaves serrate. Plants erect or ascending.

1. *Mecardonia*.

Pedicels bracted at apex (just beneath calyx).

Fertile filaments two, the anterior being rudimentary or wanting. Corolla yellow or white, its tube much longer than the lobes. Outermost sepal never more than twice width of innermost. Plants erect.

Corolla-tube broad, within densely pubescent on the posterior side. Sepals of nearly uniform length. Plants relatively lax or succulent, the leaves and sepals plane.

2. *Gratiola*.

Corolla-tube very narrow, within uniformly short-pubescent on all sides. Sepals very unequal in length. Plant stiff, the leaves and sepals revolute.

3. *Sophronanthe*.

Filaments four, all with anthers. Corolla blue or white, its tube little longer than the lobes. Outermost sepal over twice width of innermost. Plants repent.

Corolla pubescent within over bases of all lobes, blue throughout; posterior lobes united to apex. A circle of bristles surrounding the base of the ovary. Outer sepal slightly cordate, evidently exceeding the linear-attenuate innermost. Capsule less than one half as broad as long. Pedicels spreading in fruit. Leaves clasping, broadest proximally, crenate, with five to seven longitudinal nerves. Stem pubescent. Plant lemon-scented.

4. *Hydrotrida*.

Corolla glabrous within, the throat yellow, the lobes white; posterior lobes distinct. No hypogynous bristles. Outer sepal ovate, scarcely exceeding the lanceolate innermost. Capsule over one half as broad as long. Pedicels reflexing in fruit. Leaves cuneate at base, spatulate-oblong, entire, with one evident longitudinal nerve. Stem glabrous. Plant inodorous.

5. *Bramia*.

Pedicels not bracteolate. Leaves palmately veined. Styles distinct near apex. Sepals four or five, very obtuse, unequal in width. Corolla white. Plants repent; the stems pubescent.

Corolla 7-8 mm. long, five-lobed (because the two posterior and the three anterior lobes are all developed and distinct). Stamens four. Sepals five or four. Leaves entire.

6. *Macwillamia*.

Corolla 2 mm. long, three-lobed (because the two posterior lobes have united, and the anterior petal is lost leaving the anterior lip two-lobed). Stamens three (only one of the antero-lateral pair developed). Sepals four. Leaves repand.

7. *Hydrathelium*.

Anther-sacs separated on short arms of the connective. Seeds longitudinally striate, the striae tuberculate. Leaves cordate-clasping at base. Corolla blue. Pedicels bibracteolate. Plants erect or repent; the stems pubescent.

8. *Stemodia*.

Corolla violet-blue or white, with two raised ridges (each formed by the adherence of a filament) to the antero-lateral sinuses and which project as knob-like processes beyond those points (the free portion of the filament appearing as a lateral outgrowth of the adherent portion.) Posterior lobes of the corolla less than two thirds the length of the anterior. Seeds with fine transverse lines. Pedicels never bracteolate. Perfect stamens two.

Corolla violet-blue, 6-11 mm. long, the posterior lobes distinct distally. Postero-lateral stamens perfect, the antero-lateral filaments without anthers. Style with an enlarged white base. Sepals five. Capsule two-celled, oval in outline, 2-5 mm. long. Plants erect or ascending.

9. *Ilysanthes*.

Corolla pale-lavender or white, 1.5-2 mm. long, the posterior lobes united throughout. Postero-lateral stamens lost, the antero-lateral filaments with anthers. Style filamentous to base. Sepals four (the posterior

lost). Capsule one-celled at maturity (by loss of septum distally, the placentae being short), globose, 1 mm. long. Plant repent. 10. *Globifera*.

Leaves bipinnatifid. Seeds pale greenish-yellow, ridged, with faint transverse lines. Corolla lavender. Pedicel not bracteolate. Plant erect. 11. *Leucospora*.

II. MIMULEAE.

12. *Mimulus*.

III. VERBASCEAE.

13. *Verbascum*.

IV. LEUCOPHYLLEAE.

14. *Leucophyllum*.

V. CHELONEAE.

Seeds angled, maturing many to a cell. Corolla-lobes uniformly colored, shorter than the tube which is not pouched at base posteriorly. Posterior filament a conspicuous process. Sepals nearly or quite distinct. Inflorescence compound. Plants perennial, stiff, 3-20 dm. tall.

Corolla 15-50 mm. long, red, blue, or white, its three anterior lobes projecting or slightly recurving. Sterile filament elongate, slender, white. Sepals 3-13 mm. long. Seeds irregularly polyedral. Inflorescence a thyrus or relatively narrow panicle. Cauline leaves sessile, mostly clasping. Stem terete. 15. *Penstemon*.

Corolla 6-12 mm. long, red-brown, its antero-lateral lobes vertically projecting and its anterior lobe deflexed. Sterile filament wider than long, two-lobed, yellow or brown. Sepals 2.5-3 mm. long. Seeds oblong, ridged. Inflorescence a panicle. Cauline leaves petioled. Stem quadrangular. 16. *Scrophularia*.

Seeds rounded, smooth, maturing one to each cell. Anterior corolla-lobes blue, the posterior white, all longer than the tube which is strongly pouched at base posteriorly. Posterior filament a crescentic scarcely raised process. Sepals united over one third length, enclosing over half the capsule. Inflorescence racemose, often several flowers to an axil. Plant annual, lax, 1-3 dm. tall. 17. *Collinsia*.

VI. ANTIRRHINEAE.

Corolla broad (10 mm. wide), blue, with prominent yellow palate, its tube saccate at base anteriorly. Sepals 8-10 mm. long. Leaves petioled, the blade triangular, hastate with broad lobes. Stems elongate, twining.

18. *Maurandya*.

Corolla narrow, yellow or blue, its tube with a conspicuous spur at base anteriorly. Sepals 3 mm. long. Leaves sessile, linear. Stems erect. 19. *Linaria*.

VII. VERONICEAE.

Leaves whorled. Corolla white or pinkish, its lobes shorter than the tube. Capsule acute, longer than wide, not flattened, dehiscing by short apical slits. Seeds slightly reticulate. Plant 10-20 dm. tall. 20. *Veronicastrum*.

Leaves opposite or alternate. Corolla blue or white, its lobes longer than the tube. Capsule truncate to deeply notched, wider than long, flattened, dehiscing its entire length. Seeds not reticulate. Plants lower.

21. *Veronica*.

VIII. BUCHNEREAE.

Corolla yellow or pink, the throat inflated and the orifice widely open. Stamens all with anthers two-celled. Filaments and style nearly as long as or longer than the tube of the corolla. Capsule exserted from the calyx-tube. Pedicels not bracteolate.

Anther-cells glabrous or with a few bristle-like hairs at apex.

Stigma short, punctiform or capitate. Filaments dilated-flattened and pubescent. Corolla yellow.

Corolla densely pubescent within on all sides, its lobes all distinct and slightly shorter than the tube. Filaments clearly didynamous, dilated and pubescent throughout. Anther-sacs each opening by a slit its entire length. Style short, thick, more or less bilobed, persistent and reflexed on the capsule. Pedicels 1-2 mm. long. Plant stout, 15-20 dm. tall, the leaves 10-30 cm. long. 22. *Dasistoma*.

Corolla slightly pubescent within (in a ring about the base of the filaments and below the posterior sinus), its lobes longer than the tube, the two posterior united nearly one half their length. Filaments nearly equal, dilated and pubescent proximally for not over half their length. Anther-sacs each opening by a slit not over half its length. Style long, slender, entire, deciduous, straight. Pedicels 3-12 mm. long. Plants more slender, 2-10 dm. tall, the leaves 1-3 cm. long.

23. *Afzelia*.

Anther-cells lanose on the valvular surface. Stigma linear, consisting of a line down each side of the linguiform style-apex. Filaments slender, not dilated, more or less lanate.

Corolla yellow. Capsule acute to acuminate. Leaves lanceolate to ovate, entire to bipinnatifid, petioled. Stem stout, over 5 dm. tall. 24. *Aureolaria*.

Corolla pink, with red spots within on the anterior side. Capsule rounded, with a mucro. Leaves filiform to lanceolate, sessile. Stem usually slender.

Stem ascending-scabrous to glabrous. Leaves lanceolate to filiform, entire or slightly lobed at base. Pedicels 1 mm. long or more. Calyx-lobes linear to subulate, slightly longer than to much shorter than the tube. Anther-sacs of both pairs of stamens uniform. Capsule oblong to globose, 3-11 mm long. Seeds closely reticulate. 25. *Agalinis*.

Stem retrorse-hispid. Leaves lanceolate and usually auricled at base, or bipinnatifid. Pedicels less than 1 mm. long. Calyx-lobes ovate, longer than the tube. Anther-sacs of posterior stamens shorter. Capsule ovate, 8-13 mm. long. Seeds reticulate with raised ridges. 26. *Otophylla*.

Corolla purple-blue or white, salverform, the tube very narrow and densely pilose within, the lobes widely spreading. Stamens each with but one anther-sac developed. Filaments and style less than one half length of corolla-tube. Capsule mostly or quite enclosed within calyx-tube. Pedicels bibracteolate. 27. *Buchnera*.

IX. RHINANTHEAE.

Sepals five, all distinct, the posterior shorter than the others. Pedicels bibracteolate. Capsule turgid, septicidal, only tardily slightly loculicidally dehiscent. Seeds linear, flat, 2 mm. long. 28. *Schwalbea*.

Sepals four, those of each side united, the posterior one wanting. Pedicels not bracted. Capsule flattened, loculicidal, splitting even across the septum. Seeds turgid.

Corolla greenish to yellow distally, the posterior lobes projecting, not hooded at apex, the anterior lobes much shorter and at least proximally somewhat thickened and deep-green. Capsule cylindric, equally two-celled, in dehiscence splitting on both posterior and anterior sides; shorter than and enclosed within the calyx. Seeds many, reticulate. Bracts foliaceous, usually distally yellow or red. Leaves entire to pinnatifid-lobed.

29. *Castilleja*.

Corolla yellow throughout, the posterior lobes arched, hooded at apex, the anterior lobes well-developed, membranous, thin, colored. Capsule ensiform, unequally two-celled, splitting only on the posterior side; exserted from and twice the length of the calyx. Seeds few, not reticulate. Bracts not colored. Leaves bipinnatifid-lobed. 30. *Pedicularis*.

1. **MECARDONIA** Ruiz and Pavon.

Mecardonia R. and P., Syst. Veg. Fl. Peruv. et Chil. 164. 1798.

Type species, *M. ovata* Ruiz & Pavon, of Peru.

Corolla white, its posterior lobes united $\frac{1}{2}$ - $\frac{2}{3}$ their length. Outer sepals lanceolate, rarely more than twice width of inner. Leaf-blades prevailingly lanceolate, conspicuously cuneate at base. Erect or somewhat diffuse.

1. *M. acuminata*.

Corolla yellow, its posterior lobes united nearly to apex. Outer sepals narrowly ovate to ovate, more than three times width of inner. Leaf-blades prevailingly ovate or oval, more shortly cuneate at base. Procumbent or ascending.

2. *M. peduncularis*.

1. **Mecardonia acuminata** (Walt.) Small.

Gratiola acuminata Walt., Fl. Carol. 61. 1788. Type not verified, but description evidently of plant here considered. Doubtless from lower South Carolina where this plant is common.

Pagesia leucantha Raf., Fl. Ludov. 49. 1817. "Chelone 2. Rob. p. 406." In Robin, Voy. Louisiane . . . 3: 406. 1807, is a description unmistakably of the plant here considered. Robin even mentions two little leaflets in each leafaxil, by which are evidently denoted the bractlets subtending the base of the pedicel, the presence of which has been generally overlooked. Type of genus *Pagesia* Raf., l. c. 48.

Gratiola rigida Raf., Atl. Jour. 1: 176. 1833. "Texas (or) Arkansas, in my Herbarium." Type not known to exist. Description can apply to only this species, the rigid stems, leaf-outline, and narrow calyx-lobes with the superior one broader, being distinctive.

Mecardonia acuminata (Walt.) Small, Fl. S. E. Un. St. 1065, 1337. 1903.

Corolla white, within with longitudinal pink veins on the posterior side. Flowering from May to September, and soon ripening fruit.

Moist sandy loam, or heavier loam soil, usually near streams, in pineland or deciduous woodland, frequent or common through the Coastal Plain of eastern Arkansas, Louisiana and eastern Texas (probably absent from the Mississippi bottom-land); also inland, probably along sandy river- and creek-beds to eastern Oklahoma. Ranges from Maryland to Florida and Texas, extending inland to western Kentucky, southern Missouri and eastern Oklahoma.

ARKANSAS. Hot Spring: Eggert (Y). Jefferson Springs, Pennell 10662 (Y). Miller: Texarkana, Letterman (Y). Nevada: Prescott, Letterman (U). Pulaski: Little Rock, Hasse (Y).

OKLAHOMA. Creek: Sapulpa, Bush 407 (U, Y).

LOUISIANA. Caddo: Shreveport, Gregg (A). Calcasieu: DeQuincy, Pennell 10229 (Y). West Carroll: —, Moseley (U).

TEXAS. Bowie: Texarkana, Heller 4170 (A, U, Y). Brazoria: Columbia, Bush 1413 (A, Y). Harris: Harrisburg (U); Houston, Fisher 1744 (U).

2. *Mecardonia peduncularis* (Benth.) Small.

Herpestis peduncularis Benth. in Compan. Bot. Mag. 2: 56. 1836. "Hab. Texas on the Rio Brazos, Drummond (v. s.)." Type not verified, but description sufficiently distinctive.

Mecardonia viridis Small, Fl. S. E. Un. St. 1065, 1338. 1903. "Type, Heller, Pl. So. Tex., no. 1460, in Herb. C. U." Type, collected at Corpus Christi, Nueces Co., Texas, Mar. 14-21, 1894, seen in Herb. Columbia University at the New York Botanical Garden.

Mecardonia peduncularis (Benth.) Small, l. c. 1065, 1338. 1903.

Closely allied to the wide-spread Tropical *Mecardonia procumbens* (Miller) Small, but apparently distinguishable by narrower outer sepals and longer pedicels. *M. tenuis* Small of the Florida Keys and the Bahamas seems to differ constantly from this in possessing sepals 5-6 mm. long instead of 7-9 mm. long.

Corolla yellow, within with longitudinal brown veins especially on the posterior side. Flowering from March to May, and soon ripening fruit; lingering blossoming later.

Sandy or clayey soil, prairie or open woodland, common on the Coast Prairie of middle coastal Texas, frequent inland across the Coastal Plain and along stream-courses entering the hills of the Edwards Plateau and the Burnet Metamorphic Region; ranges from Walker and Brazoria to Burnet, Bexar and Duval counties, Texas.

TEXAS. Austin: Kenney, Pennell 10305 (M, T, Y); Wallis, Pennell 10269 (C, P, U, Y). Bexar: Comanche Spring, Lindheimer 1054 (A, T, U, Y); San Antonio. Blanco: Blanco, Reverchon 1574 (U). Brazoria: Columbia, Bush 134 (U, Y). Burnet: Fairland, Pennell 10475 (A, H, K, Y). Marble Falls. Comal: Bracken; New Braunfels, Lindheimer 1055 (U, Y). Dewitt: Cuero, Bray 127 (U). Duval: San Diego, Croft (U). Gillespie: Jermy 168 (). Harris: Harrisburg, Pennell 10249 (H, Y); Houston, Pennell 10247 (Y), 10252 (C, M, Y), 10260 (A, H, J, L, M, O, P, S, T, U, Y). Hays: San Marcos, Stanfield (Y). Kerr: Kerrville, Pennell 10378 (Y). Lampasas: Lampasas, Plank (Y). Nueces: Corpus Christi, Heller 1460 (A, U, Y). Travis: Barton Springs; Shoal Creek, Young (T). Victoria: Victoria, Lewton 96 (U). Walker: Huntsville, Young (T).

2. *GRATIOLA* Linné.

Gratiola L., Sp. Pl. 17. 1753.

Type species, *G. officinalis* L., of Europe.

Corolla slightly exceeding calyx, externally glabrous. Capsule nearly pyramidal, acuminate. Pedicels very short. Leaves

lanceolate-ovate to crenate, rounded at base. Plant pubescent with several-celled hairs.

1. *G. pilosa*.

Corolla at least twice as long as the calyx. Capsule broader, acute to rounded. Pedicels longer. Stem glabrous or pubescent with one-celled hairs, these frequently gland-bearing. Corolla within throat on posterior side densely pubescent with knobbed hairs. Capsule ovate in outline, 1-5 mm. long. Seeds .3-.5 mm. long, semi-globose to oblong. Pedicels slender, at least twice the length of the sepals.

Capsule 1-2 mm. long, much exceeded by the sepals. Stem-leaves clasping by a broad base, denticulate, usually at least the upper with resinous dots. Root-stocks developed, perennial, slender.

2. *G. ramosa drummondii*.

Capsule 3-5 mm. long, about equaled by or longer than the sepals. Stem-leaves narrowed to a sessile or slightly clasping base, obscurely or not resinous-dotted. Roots apparently annual, the main root short.

Corolla-lobes white, the tube yellowish. Capsule globose-ovate, about equaled by the sepals. Seeds yellowish, the reticulations relatively fine and not making the seed rough in contour. Stems relatively thick and fleshy.

Corolla externally glandular-puberulent. Leaves 2-5 cm. long, ovate-lanceolate, serrate-dentate distally.

3. *G. neglecta*.

Corolla externally glabrous (apparently). Leaves .5-1.5 cm. long, nearly linear, entire.

4. *G. gracilis*.

Corolla golden yellow throughout, glabrous externally.

Capsule ovate-pyramidal, nearly twice as long as the sepals. Seeds brown, the reticulations relatively coarse and making the seed rough in contour. Stem thin, not fleshy.

5. *G. flava*.

Corolla within throat on posterior side pubescent with unknobbed hairs. Capsule globose, 5-6 mm. long. Seeds .7 mm. long, linear. Pedicels stout, less than twice the length of the sepals. Leaves and root as in *neglecta*.

6. *G. virginiana*.

1. *Gratiola pilosa* Michx.

Gratiola pilosa Michx., Fl. Bor. Am. 1: 7. 1803. "Hab. in Carolinae inferioris uliginosis [A. Michaux]." Description sufficiently distinctive.

Corolla white, throat distally with faint bluish-purple lines on all petals. Flowering from June to September, and soon ripening fruit.

Moist sandy soil, pineland or deciduous woodland, through the Coastal Plain of eastern Arkansas, Louisiana, and eastern Texas. Ranges from New Jersey to Florida, central Arkansas, and eastern Texas.

ARKANSAS. Jefferson: Kearney, Pennell 10656 (Y). Pulaski: Little Rock, Letterman 359 (U, Y).

LOUISIANA. Calcasieu: De Quincy, Pennell 10237 (Y). Rapides: Alexandria, Hale (Y).

TEXAS. Austin: Kenney, Pennell 10304 (Y). Smith: Swan, Reverchon 3218 (U, Y). Weller: Hempstead, Hall 413 (U, Y).

2. *Gratiola ramosa drummondii* (Benth.) Pennell, comb. nov.

Gratiola drummondii Benth. in DC., Prod. 10:05. 1846. "In . . . Texas (Drummond! coll. 3. n. 285) . . . (v. s.)" Isotypes seen in herbaria of Columbia University at the New York Botanical Garden and of the Academy of Natural Sciences of Philadelphia.

Corolla with tube dull-yellow, the lobes dull-white, the tube with longitudinal brown lines. Flowering from April to September, and soon ripening fruit.

Moist or wet sandy pineland, edge of ponds, in and near pineland in the Coastal Plain of Louisiana and eastern Texas, probably in southeastern Arkansas; inland seen from the gravelly bed of the San Bois River in Haskell county, Oklahoma.

ARKANSAS. — : Leavenworth (Y).

OKLAHOMA. Haskell: San Bois River, Bigelow (U, Y).

LOUISIANA. Calcasieu: De Quincy, Pennell 10222 (A, H, K, L, M, T, U, Y); Lake Charles, Allison 296 (U, Y); St. Landry: Chat-eigner, Langlois (Y).

TEXAS. Angelina: — , Reverchon 3930 (U). Montgomery: Harmon's Creek, Dixon 453 (Y). Waller: Hempstead, Hall 412 (U, Y).

Apparently *Gratiola ramosa* Walt. (Fl. Carol. 61. 1788) includes two incipient species to be distinguished as follows:

Capsule usually wider than long. Sepals more than twice as long as the capsule, usually subtended by one or two sepal-like bractlets. Stems 2–4 dm. long, more laxly ascending, its leaves usually 1.5–2.5 cm. long. Plant usually less fleshy. Southwestern Georgia and northcentral Florida to Texas and Oklahoma.

G. ramosa drummondii.

Capsule as long or longer than wide. Sepals usually about twice as long as the capsule, subtended by one small bractlet or none. Stems 1–2 (–3) dm. tall, strictly erect, its leaves usually less than 1.5 cm. long. Plant more fleshy. South Carolina to Southern Florida, and, occasionally, westward to eastern Louisiana.

G. ramosa.

3. *Gratiola neglecta* Torr.

Gratiola neglecta Torr., Cat. Pl. N. Y. 89. 1819. "Within thirty miles of the City of New York." Probable type seen in Herb. of Columbia University at the New York Botanical Garden. For discussion see Torrey 19: 146. 1919.

Corolla with tube greenish-yellow, the lobes white, at times pinkish. Flowering from April to June, and soon ripening fruit.

Wet loam, frequently sandy, usually in deciduous woodland, through the Coastal Plain of Arkansas, Louisiana, and eastern Texas; more common in the upland of Arkansas and eastern Oklahoma. Ranges across the continent northward.

ARKANSAS. Jefferson: Jefferson Springs, Pennell 10673 (Y), 10674 (A, C, H, K, L, M, U, Y). Pope: Russellville, Pennell 10624 (M, Y). Pulaski: Little Rock, Hasse (Y).

OKLAHOMA. Rogers: Verdigris, Bush 410 (U).

LOUISIANA. Rapides: Alexandria, Hale (L). St. Landry: Ville Platte, Langlois (Y).

TEXAS. Bowie: Dalby, Milligan (U). Harris: Hockley, Thuron (U). Liberty: Dolen, Young (T).

4. *Gratiola gracilis* Benth.

Gratiola gracilis Benth., in DC. Prod. 10: 402. 1846. "In Texas prope Harrisburgh (Drummond! Coll. 3. n. 284) . . . (v. s.)". Type not verified, and my search for the plant at Harrisburgh in May, 1920, failed.

Gratiola torreyi Small, Fl. S. E. Un. St. 1066, 1338. 1903. "Type, Wright Mex. Bound. Surv., in Herb. C. U." Type collected on the "Colorado and Blanco Rivers, Texas," seen in the Herbarium of Columbia University at the New York Botanical Garden. Plant smaller and leaves narrower than described for *G. gracilis*. Although described as "corolla golden-yellow," the lobes as shown in the type were clearly white.

Apparently in the Coastal Plain of middle coastal Texas, extending to the base of, or entering along streams, the hills of the Edwards Plateau of central Texas. Little-known.

5. *Gratiola flava* Leavenworth, nom. nov.

Gratiola pusilla Torr.; Benth. in DC. Prod. 10: 402. 1846. "In campis humidis Texas! Arkansas! . . . (v. s. comm. a cl. A. Gray.)" Probably based on collections of Dr. Leavenworth. Not *G. pusilla* Willd., Sp. Pl. 1: 105. 1797.

The name "*Gratiola flava*" occurs with a specimen of Dr. Leavenworth's, labeled as from "prairies near the Sabine River, Texas," and which is in the Herbarium of the Academy of Natural Sciences of Philadelphia. Very probably this is an isotype of *G. pusilla* Torr., as specimens of the same collection are in the Herbarium of Columbia University.

Sandy prairies in and near the pinelands of southern Arkansas,

western Louisiana and eastern Texas. Little-known. Flowering in May and June, and soon ripening fruit.

ARKANSAS. Leavenworth (Y).

LOUISIANA. Hale (Y).

TEXAS. Waller: Hempstead, Hall 414 (A, U, Y).

6. **Gratiola virginiana** L.

Gratiola virginiana L., Sp. Pl. 17. 1753. "Habitat in Virginia." For discussion of the type of this see S. F. Blake in *Rhodora* 20: 65. 1918.

Corolla white, within with longitudinal purple lines, more pronounced on posterior side. Flowering from March to May and soon ripening fruit.

Wet loam, in shade, usually along streams, in the Coastal Plain of eastern Arkansas, Louisiana and eastern Texas. Ranges from New Jersey to Florida and Texas, inland in the Mississippi Valley to Illinois and Missouri.

ARKANSAS. Jefferson: Eggert (Y). Pulaski: Little Rock, Hasse (Y).

LOUISIANA. "New Orleans," Drummond (Y).

TEXAS. Bowie: Texarkana, Letterman (Y). Harris: Houston, Biltm. hb. 1215a (U).

3. **SOPHRONANTHE** Benth.

Sophranthe Benth.; Lindl., Nat. Syst. Bot. ed. ii. 445. 1836.

Type species, *S. hispida* Benth.

1. **Sophranthe hispida** Benth.

Sophranthe hispida Benth., l. c. 445. 1836. "The plant was gathered by Drummond at Apalachicola." Isotype, Drummond 20, seen in Herbarium of Columbia University at the New York Botanical Garden.

Corolla with tube externally yellowish-white, within and on lobes white. Flowering from May to September, and soon ripening fruit.

To be expected in the dry sandy long-leaf pineland, but specimens have been seen only from Cameron Parish, Louisiana. Ranges within this belt, from Southern Georgia and Florida westward to Louisiana.

LOUISIANA. Cameron: Cameron, Tracy 8710 (Y).

4. **HYDROTRIDA** Small.

Hydrotrida Small, Fl. Miami 165. 1913.

Type species, *Obolaria caroliniana* Walt.

1. **Hydrotrida caroliniana** (Walt.) Small.

Obolaria caroliniana Walt., Fl. Carol. 166. 1788. Type not verified, but description sufficiently distinctive. Doubtless from lower South Carolina, a district where the species now considered is frequent.

Hydrotrida caroliniana (Walt.) Small, l. c. 165. 1913.

Corolla uniformly sky-blue. Flowering from May to September and soon ripening fruit.

Aquatic in shallow water, sandy soil, edges of ponds and in small streams in long-leaf pineland of southern Louisiana. Ranges within this belt, from North Carolina to Florida and Louisiana.

LOUISIANA. Calcasieu: Lake Charles, Allison 209 (U, Y); Perkins, Pennell 10213 (Y). Rapides: Alexandria, Hale (C, U).

5. **BRAMIA** Lamarck.

Bramia Lam., Encyc. Meth., Bot. 1: 459. 1785.

Type species, *B. indica* Lam., of India.

1. **Bramia monnieri** (L.) Pennell.

Lysimachia monnieri L., Cent. Pl. 2: 9. 1756. "Habitat in America meridionali. Hallman." D. Z. Hallman sent to Linné specimens from Spain, so it would appear that the type of this was probably transmitted through him from some source in Spanish America.

Bramia monnieri (L.) Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 243. 1920.

Corolla, with tube yellowish within, elsewhere white or tinged with pink. Flowering from April to September, and soon ripening fruit.

Sandy shores, especially where subject to inundation, along the coast of Louisiana and Texas, common within tidewater, both where brackish and where fresh; also inland along streams, in central Texas to Burnet and Gillespie counties. From North Carolina southward through Tropical America. Also in the Old World Tropics.

LOUISIANA. Calcasieu: Lake Charles, Allison 62 (U). Jefferson: Gretna, Ball 363 (U, Y). Plaquemines: South Pass, Tracy & Lloyd 90 (U).

TEXAS. Bexar: (U). Brazoria: Columbia, Bush 1567 (U). San Antonio, Schulz 149. Burnet: Granite Mountain, Pennell 1046: (A, H, M, U, Y). Cameron: Rio Hondo, Chandler 7016 (U). Comal: New Braunfels, Lindheimer 1056 (A, T, U, Y). Galveston. Galveston, Ward (U, Y). Gillespie: Threadgill, Jermy 612 (U). Guadalupe: Seguin, Groth 182 (U). Harris: Hockley; Houston, Hall 415 (U). Nueces: Corpus Christi, Heller 1823 (A, U, Y). Travis: Barton Creek, Young (T).

6. **MACUILLAMIA** Rafinesque.

Macuillamia Raf., Autik. Bot. 44. 1840.

Type species, *Monniera rotundifolia* Michx.

1. **Macuillamia rotundifolia** (Michx.) Raf.

Monniera rotundifolia Michx., Fl. Bor. Am. 2: 22. 1803. Hab. in regione Illinoensi [A. Michaux].'' Type not verified, but description sufficiently distinctive.

Macuillamia rotundifolia (Michx.) Raf., l. c. 44. 1840.

Ranapalus rotundifolius (Michx.) Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 242. 1920.

Corolla with tube yellow within, the lobes white. Flowering from June to October, and soon ripening fruit.

Aquatic in shallow mud-bottomed open ponds, through the upland of central Oklahoma and northern Texas, south to Travis County; also in bottom-lands of the Coastal Plain. Ranges from Indiana and Tennessee to North Dakota, eastern Colorado and central Texas.

ARKANSAS. St. Francis: Mud Lake, McAtee 1851 (U).

OKLAHOMA. Washington: Copan, Stevens 2082 (U).

LOUISIANA. Rapides: Alexandria, Hale (L, U, Y).

TEXAS. Dallas: Dallas, Reverchon (Y). Matagorda: Bay City, Fisher 166 (U). Randall: Paloduro Canyon,—(T). Tarrant: Polytechnic, Ruth 579 (Y). Travis: Austin, Tharp (T).

7. **HYDRANTHELIUM** Humboldt, Bonpland, and Kunth.

Hydranthelium H. B. K., Nov. Gen. et Sp. 7: 202. 1825.

Type species, *H. callitrichoides* H. B. K., of Venezuela.

1. **Hydranthelium egense** Poepp.

Hydranthelium egense Poepp., Nov. Gen. et Sp. 3: 75. t. 287. 1845. "Crescit in paludibus ad Ega in Brasilia boreali, Octobre lectum [Eduardus Poeppig in 1827-32]."

There can be no doubt of the identity of the Louisiana aquatic with this species of Brazil. The exceedingly small flowers of this genus and the occurrence of the plants in river-sloughs, cause them to be little observed, and the species may be widely distributed through Tropical America. *H. egense* has likely been brought to Louisiana by bird-migrants.

Aquatic in sloughs in central Louisiana. Probably introduced from South America.

LOUISIANA. Rapides: Alexandria, Hale (Y).

8. **STEMODIA** Linné.

Stemodia L., Syst. Nat. ed. X. 1118. 1759.

Type species, *S. maritima* L., of Jamaica.

Corolla glabrous within on posterior side, hirsute within anteriorly. Bractlets lanceolate-linear, at least half the length of the sepals. Lower pedicels as long as or longer than the calyx. Herbage finely hispid-pubescent, slightly glandular. Stems erect, 1-6 dm. tall.

S. schottii.

Corolla densely pubescent within on posterior side, pubescent with shorter hairs anteriorly. Bractlets subulate, less than half length of sepals. Pedicels all much shorter than the calyx. Herbage white-lanose, not glandular. Stems extensively repent.

S. tomentosa.

1. ***Stemodia schottii*** Holz.

Stemodia schottii Holz., in Contrib. U. S. Nat. Herb. 1: 286. pl. 20. 1893. "Habitat, southern Texas, along the Rio Grande. Collected by Dr. Schott at Rio Grande, Texas, in 1853; and by G. C. Nealley, at Comstock, Valverde County, Texas, in 1889 (No. 305)." Type seen in United States National Herbarium.

Valverde County, Texas. Ranges from Texas to southern California, and south to Jalisco. Nearly related to the wide-spread Tropical American *S. durantifolia* (L.) Sw., but seeming to differ in its lower habit and longer pedicels. Needs further field study.

2. ***Stemodia tomentosa*** (Mill.) Greenm. & Thoms.

Erinus tomentosus Mill., Gard. Dict. ed. VIII. n. 2. 1768. "Sent . . . by the late Dr. Houstoun from La Vera Cruz." Description sufficiently distinctive.

Stemodia tomentosa (Mill.) Greenm. & Thoms., in Ann. Missouri Bot. Gard. 1: 409. 1915.

Recorded in Coulter's Botany of Western Texas under the later, but more appropriate, name, *Stemodia lanata* Ruiz & Pavon.

Sands of the seashore, extreme southern Texas. Ranges southward along the Gulf coast to Vera Cruz

TEXAS. Cameron: Brazos Santiago, Nealley 348 (U).

9. **ILYSANTHES** Rafinesque.

Ilysanthes Raf., Ann. Nat. 13. 1820.

Type species, *I. riparia* Raf., of the banks of the Ohio.

Pedicels relatively stout, at least in fruit shorter than the bracts.

Leaves 1-3 cm. long, usually obviously narrowed at base. Sepals usually finely pubescent, usually about equaling the capsule.

I. dubia.

Pedicels filiform, longer than the bracts. Leaves .5-1.5 cm. long, rounded at base, or at least broadest much below the middle. Sepals glabrous or nearly so, shorter than the capsule.

I. inaequalis.

1. ***Ilysanthes dubia*** (L.) Barnhart.

Gratiola dubia L., Sp. Pl. 17. 1753. "Habitat in Virgiana aquosis . . . Gron. virg. 129". Type, Clayton 164, identified by Dr. B. L. Robinson in Rhodora 10: 67, 1907, as the species here considered.

Ilysanthes dubia (L.) Barnhart, in Bull. Torr. Bot. Club 26: 376. 1899.

Corolla pale lavender, deeper in color near margin of lobes, and within on the antero-lateral ridges with short yellow hairs. Flowering from May to September, and soon ripening fruit.

Swamp and stream margins, especially where shaded, loam soil; probably most prevalent in the upland of Arkansas and eastern Oklahoma, entering the Coastal Plain of Louisiana and north-eastern Texas, especially in bottom-lands. Ranges from New Brunswick and Ontario to Wisconsin, Kansas, Florida and Texas; also in the West Indies and South America.

ARKANSAS. Poinsett: Marked Tree, Bush 141 (U, Y).

OKLAHOMA. Ottawa: Miami, Stevens 2313 (U).

LOUISIANA. Morehouse: Mer Rouge, Bush 143 (Y). Rapides: Alexandria, Ball 473 (U, Y). West Carroll: —, Moseley (U).

TEXAS. Bowie: Texarkana, Heller 4176 p. p. (Y).

2. *Ilysanthes inaequalis* (Walt.) Pennell.

Gratiola inaequalis Walt., Fl. Carol. 61. 1788. Type not verified, but is doubtless from lower South Carolina where the plant here considered is frequent.

Gratiola brevifolia Raf., Atl. Journ. 1: 176. 1833. "Texas [or] Arkansas, in my herbarium." Type not known to exist. The small incurved purplish corolla would indicate this genus, and the short ovate leaves with pedicels longer than these, this species. Evidently but a scrap of a plant, or the plant would not have been described as simple.

Ilysanthes inaequalis (Walt.) Pennell, in *Torrey* 19: 149. 1919.

Corolla as in *I. dubia*. Flowering from April to September, and soon ripening fruit.

Swamps and pond-margins, in loam or more usually sandy soil, frequently in open situations about pineland pools, through the Coastal Plain of Arkansas, Louisiana and eastern Texas; inland in eastern Oklahoma and central Texas, to the Burnet Metamorphic Region and even to Tom Green County. Ranges from Massachusetts to Florida and Texas, inland westward to Missouri and Colorado; also in the Pacific Coast states, Mexico, West Indies, Central and South America. Intergrades with *Ilysanthes dubia*.

ARKANSAS. Benton —, Plank (Y). Hempstead: Fulton, Bush 1036 (U). Jefferson: —, Eggert (Y).

OKLAHOMA. Payne: Perkins, Waugh 26 (U); Stillwater. Washington: Capon, Stevens 2115½ (U).

LOUISIANA. Calcasieu: Lake Charles, Plank 41 (U).

TEXAS. Austin: Kenney, Pennell 10310 (A, T, Y); Sealy, Pennell 10296 (H, U, Y); Wallis, Pennell 10265 (M, Y). Bowie: Texarkana, Heller 4176 p. p. (U). Burnet: Fairland, Pennell 10476

(C, L, Y). Harris: Hockley, Houston, Hall 416 (U, Y). Lee: Giddings, Plank (Y). Madison: —, Dixon (Y). Tarrant: Handley, Ruth 503 (U). Tom Green: —, Tweedy (Y).

10. **GLOBIFERA** J. F. Gmelin.

Globifera J. F. Gmel., Syst. 2: 32. 1791.

Type species, *Anonymos umbrosa* Walt.

1. **Globifera umbrosa** (Walt.) J. F. Gmel.

Anonymos umbrosa Walt., Fl. Carol. 63. 1788. Type, probably from lower South Carolina, identified by Dr. S. F. Blake, in Rhodora 17: 131. 1915, as the species here considered.

Globifera umbrosa (Walt.) J. F. Gmel. l. c. 32. 1791.

Corolla uniformly dull-white. Flowering from May to October and soon ripening fruit.

Wet loam or in shallow water, in woodland, especially in river-bottoms, through the Coastal Plain of Louisiana and southeastern Texas. Ranges from North Carolina to Florida and eastern Texas; also in eastern Mexico and the West Indies.

LOUISIANA. Calcasieu: Perkins, Pennell 10217 (A, C, H, K, L, M, T, U, Y). Rapides: Alexandria, Ball 466 (U, Y).

TEXAS. Harris: Sheldon, Reverchon 3936 (U). Walker: Huntsville, Dixon 368 (Y).

11. **LEUCOSPORA** Nuttall.

Leucospora Nutt., in Journ. Acad. Nat. Sci. Phila. 7: 87. 1834.

Type species, *Capraria multifida* Michx.

1. **Leucospora multifida** (Michx.) Nutt.

Capraria multifida Michx., Fl. Bor. Am. 2: 22. pl. 35. 1805. "Hab. in ripis arenosis fluminum amniculorumque, in Tenassée et Illinoensi regione." Type not verified, but description and plate certainly of species here considered.

Leucospora multifida (Michx.) Nutt., l. c. 87. 1834.

Corolla pale-lavender, deeper on lobes, and lined with deeper lavender; tube within at base greenish-yellow, then yellow on the anterior side, and toward mouth with a purplish ring; white at base of the lavender anterior lobes. Flowering from May to November, and soon ripening fruit.

Sandy or loam banks of brooks or rivers, in open meadows or along shores, through the upland of Arkansas and Oklahoma south to central Texas, entering the Coastal Plain along river banks and reaching nearly to the sea. Ranges from southwestern Ontario to Kansas, south to Alabama and Texas.

ARKANSAS. Benton: —, Plank (Y). Pulaski: Little Rock,

Hasse (Y). Sebastian: Fort Smith, Bigelow (U).

OKLAHOMA. Comanche: Cache, Stevens 1320 (U). Kay: Tonkawa, Stevens 1876 (U). Payne: Stillwater, Waugh (U). Woods: Waynoka, Stevens 1769 (U).

LOUISIANA. Rapides: Alexandria, Ball 491 (U, Y).

TEXAS. Bexar: Comanche Spring, Lindheimer 1048 (A, T, U, Y). Bowie: Texarkana, Heller 4255 (A, U, Y). Comal: New Braunfels, Lindheimer 1049 (A, T, U, Y). Dallas: Dallas, Reverchon (Y). Gillespie: Fredericksburg, Jermy 680 (U). Hays: San Marcos, Stanfield (Y). Kerr: Kerrville, Heller 1926 (A, U, Y). Matagorda: Bay City, Fisher 158 (U). Tarrant: Fort Worth, Ruth 102 (U, Y). Travis: Shoal Creek, Young (T).

12. *MIMULUS* Linné.

Mimulus L., Sp. Pl. 634. 1753.

Type species, *M. ringens* L.

Corolla yellow. Calyx strongly oblique, its posterior lobe longest, the lateral usually blunt. Capsule dehiscent laterally, apex persistent and valves permanently attached to septum. Seeds ellipsoid-orbicular. Leaf-blades broad-ovate, palmately veined. Stems repent-ascending. (*I. Simiolus.*) 1. *M. glabratus*.

Corolla lavender-violet. Calyx-lobes equal, all acuminate. Capsule dehiscent laterally from very apex, and valves splitting from septum. Seeds oblong. Leaf-blades lanceolate to ovate, pinnately veined. Stems erect. (*II. Eumimulus.*)

Leaf-blades ovate, petioled. Angles of stem slightly winged. Pedicels stout, in fruit 5-10 mm. long. Calyx-lobes setaceous-tipped, 1-2 mm. long. Corolla 35 mm. long. Seeds pale-yellow. 2. *M. alatus*.

Leaf-blades lanceolate, clasping. Angles of stem not winged. Pedicels slender, in fruit 30-60 mm. long. Calyx-lobes lanceolate, 3-5 mm. long. Corolla 30 mm. long. Seeds brownish. 3. *M. ringens*.

1. *Mimulus glabratus* H. B. K.

Mimulus glabratus H.B.K., Nov. Gen. et. Sp. 2:370. 1817. "Crescit prope Moran Mexicanorum, alt. 1330 hex." Type not verified, but description evidently of plant here considered.

Mimulus Jamesii texensis A. Gray, Syn. Fl. N. Am. 2:1:277. 1878. Texas, Wright, Lindheimer, etc. Probably in drier soils." Probable isotype seen in Herbarium of Columbia University at the New York Botanical Garden.

Very variable in size in all its parts, the larger form being *M. jamesii texensis* A. Gray or *M. inamoenus* Greene from Trans-Pecos Texas.

Corolla lemon-yellow, within throat on anterior side golden and

spotted with many red-brown spots. Flowering from April to August, and soon ripening fruit.

About springheads and ponds, and along streams, plains of central and western Oklahoma, south to the hills of central Texas (Burnet region and Edwards Plateau). Wide-ranging through America from North Dakota and Colorado south to Bolivia.

OKLAHOMA. Harper: Doby Springs, Stevens 318 (U). Love: Thackerville, Stevens 63 (U). Major: Cleo, Stevens 782 (U). Woods: Alva, Stevens 3910 (U).

TEXAS. Burnet: Granite Mountain, Pennell 10459 (C, H, Y). Comal: New Braunfels, Lindheimer 1057 (A, T, Y). Gillespie: Crab-Apple, Jermy 164 (U). San Saba: San Saba, Reverchon 1341 (U, Y). Travis: Austin, Pennell 10444 (A, L, M, U, Y); Bee Creek; Mt. Bonnell.

2. **Mimulus alatus** Ait.

Mimulus alatus Ait., Hort. Kew. 2: 361. 1789. "Nat. of North America. Introd. 1783, by Mr. William Malcolm." Type not verified, but description sufficiently distinctive.

Corolla pinkish-lavender, within throat essentially as in *M. ringens* but the spots are smaller and the color fainter. Flowering from July to August and probably ripening fruit in September and October.

Wet woods and shaded river-bottoms, loam soil, hills of eastern Oklahoma, perhaps near the Red River in Louisiana. Ranges from Connecticut to Ontario and Kansas, south to Florida, Mississippi and Oklahoma.

OKLAHOMA. Osage: Pawhuska, Stevens 2003½ (U). Pittsburg: near Gain's Creek, Bigelow (Y).

LOUISIANA. (?) On Red River, Hale (L).

3. **Mimulus ringens** L.

Mimulus ringens L., Sp. Pl. 634. 1753. "Habitat in Virginia, Canada, . . . Hort. ups. 176 t. 2." In Hortus Upsalensis 176, pl. 1. 1748. Linné described and figured our plant.

Mimulus pteropus Raf., Fl. Ludov. 44. 1817. "*M. alatus* Rob. pl. 396." This reference is to C. C. Robin, Voy. Louisiane 3: 396, 1807, in which is given a fuller description. The leaves sessile and semi-amplexicaul are distinctive. Probably from the present state of Louisiana.

I know of no other record than Robin's of the occurrence of this species in the West Gulf States. But from its wide general range, Nova Scotia to Minnesota south to Florida and Kansas, it should be expected in Arkansas and eastern Oklahoma.

13. **VERBASCUM** Linné.

Verbascum L., Sp. Pl. 177. 1753.

Type species, *V. thapsus* L., of Europe.

1. **Verbascum thapsus** L.

Old fields, roadsides and thickets. Seen from Louisiana and eastern Texas, probably frequent throughout our area. Naturalized from Eurasia.

14. **LEUCOPHYLLUM** Humboldt and Bonpland.

Leucophyllum H. & B., Pl. Aequin. 2: 95. 1809.

Type species, *L. ambiguum* H. & B., of Mexico.

1. **Leucophyllum texanum** Benth.

Leucophyllum texanum Benth. in DC. Prod. 10: 344. 1846. "Juxta Laredo prov. Texas (Berlandier!) . . . (v. s. comm. a cl. Hook.)" Probable isotype, Berlandier 2070 (labeled "2070-660"), collected "cerca Laredo, Junio, 1829," seen in Herb. of Columbia University at the New York Botanical Garden.

Corolla 18–20 cm. long, larger than, and leaves not semi-petioled as are those of the other species, *L. ambiguum* H. & B. of central Mexico and *L. minus* Gray of Trans-Pecos Texas and Chihuahua. Also the leaves and branchlets are in *ambiguum* more densely tomentose with much more widely branching hairs, in *minus* closely stellate pubescent with scarcely stalked hairs. *L. minus* is to be looked for in the western Edwards Plateau.

Corolla "rose-colored with lavender tinge," on anterior side "from base to mouth having a white ground with orange-colored splotches in four or five lines." Flowering, southward nearly throughout year, northward from June to September, and soon ripening fruit.

Hills and plains, limestone bluffs, from Austin, Travis and Gillespie counties, Texas, southward, increasing and becoming a characteristic chaparral shrub near the Rio Grande. Ranges southward through Nuevo Leon and Coahuila.

TEXAS. Austin: San Felipe, Mexican Boundary Survey (Y). Cameron: Rio Hondo, Chandler 7023 (Y). Duval: San Diego, Croft 50 (Y). Gillespie: Threadgill, Jermy 446 (U). Hidalgo: Hidalgo, Pringle 1957 (A, Y); Mission. Nueces: Corpus Christi, Heller (Y). Travis: Austin, Pennell 10450 (Y), Tharp (T, Y). Uvalde: Sabinal, Reverchon 1572 (P, U, Y); Uvalde. Webb: Laredo, Berlandier 2070 (Y).

15. **PENSTEMON** (Mitchell) Schmidel.

Penstemon Schmidel, Icon. Pl. 2. 1762.

Type species, *Chelone penstemon* L., of Virginia.

- A. Anther-cells divaricate, opening throughout. Leaves membranous or somewhat fleshy, the lower petioled (in *P. ambiguus* linear), and all the cauline leaves deciduous.

- B. Corolla scarlet, slightly fleshy, glabrous externally and within, 30-35 mm. long, the tube gradually expanding distally. Sterile filament glabrous. Upper leaves widely connate. Plant glaucous, forming winter rosettes, the stems strictly annual. (*Elmigeria*.) I. CENTRANTHIFOLII. 1. *P. murrayanus*.
- B B. Corolla purple, red, blue, or white, membranous, the throat usually more abruptly expanding. Leaves all distinct. (*Eupenstemon*.)
- C. Leaf-blades broadly-linear to ovate, at least 2 mm. wide. Corolla-throat straight or upcurved, relatively inflated. Sterile filament bearded. Plants forming winter rosettes, the stems strictly annual.
- D. Corolla-throat inflated-rounded anteriorly, within glandular-puberulent or glabrous. Seeds 2-3 mm. long.
- E. Corolla glabrous externally and internally. Anther-cells oblong. Sterile filament enlarged distally. Leaves entire, relatively thick, somewhat fleshy. Plants glaucous. II. COERULEI.
- Corolla 40-45 mm. long, the tube much inflated, the lobes slightly spreading. Sterile filament closely short-bearded near the apex. Capsule 20-25 mm. long. Bracts obtuse to acute.
2. *P. grandiflorus*.
- Corolla 15-20 mm. long, lined with deeper color, the tube little inflated, the lobes strongly spreading. Sterile filament relatively densely bearded distally. Capsule 10-16 mm. long. Bracts acuminate.
- Corolla pale-lavender, its lobes 3-4 mm. long. Sterile filament slightly widening and moderately bearded distally with dull-yellowish hairs. Capsule 14-16 mm. long. Bracts broad, mostly surrounding the fruits, becoming conspicuously reticulate. Foliage dull-glaucous.
3. *P. buckleyi*.
- Corolla blue, its lobes 4-5 mm. long. Bracts not becoming reticulate. Foliage pale-glaucous.
- Sepals 6-7 mm. long, more attenuate. Sterile filament slightly enlarging and moderately bearded distally with short orange-yellow hairs. Capsule 13-15 mm. long. Bracts, except the uppermost, longer than the pedicels. Leaf-blades linear to lanceolate, acuminate, longer than the internodes.
4. *P. angustifolius*.
- Sepals 5-6 mm. long, acuminate. Sterile filament more enlarged and usually more densely bearded, the beard of golden-yellow hairs. Capsule 10-12 mm. long. Bracts shorter than the pedicels, often

only rudimentary. Leaf-blades ovate, obtuse to acutish, mostly shorter than the internodes.

5. *P. fendleri*.

EE. Corolla glandular-puberulent externally and internally. Anther-cells as wide as long. Sterile filament slender, not or but slightly enlarged distally. Leaves usually serrate, thinner, firm, membranous. Plants not glaucous. III. ALBIDI.

Corolla 15-20-25 mm. long, white or violet-tinged, its posterior lobes united less than half their length. Anthers dark violet-gray. Capsule 10-15 mm. long. Stem-leaves broadly linear to lanceolate, entire or serrate.

Leaves permanently more or less canescent, lanceolate, those of the basal tufts narrowly ovate. Capsule ellipsoid-ovate to ovate in outline, 5-7 mm. wide.

6. *P. albidus*.

Leaves glabrous (except for minute line along midrib above), broadly linear, those of the basal tufts broadly or spatulate-linear. Capsule globose-ovate in outline, 7-8 mm. wide.

7. *P. guadalupensis*.

Corolla 25-50 mm. long, violet-purple to white, its posterior lobes united more than half their length. Anthers gray. Capsule 15-20 mm. long. Stem-leaves lanceolate to ovate, mostly serrate.

Corolla 25-40 mm. long, its throat gradually expanding from the tube, moderately inflated and not narrowing to orifice. Sepals acuminate.

8. *P. triflorus*.

Corolla 40-50 mm. long, its throat abruptly expanding from the tube, strongly inflated and narrowing to orifice. Sepals acutish to slightly acuminate.

Corolla pale-purple, more widely inflated, usually obscurely glandular within. Foliage pale-green.

9. *P. cobaea*.

Corolla deep-purple, less widely inflated, more evidently glandular within. Foliage deeper green.

9a. *P. cobaea purpureus*.

DD. Corolla-throat more or less flattened, two-ridged within, anteriorly (scarcely so in *P. tubiflorus*). Seeds .8-1 mm. long.

E. Corolla white, not lined, glandular-puberulent within on all sides; the throat slightly inflated and scarcely or not two-ridged within, the lobes widely spreading. Stem and leaves glabrous, the latter entire or very nearly so. IV. TUBIFLORI.

10. *P. tubiflorus*.

EE. Corolla white or pink, usually with lines of deeper color, somewhat pubescent with glandless hairs within over bases of anterior lobes; the throat inflated and two-ridged within anteriorly. Leaves more or less serrate. V. GRACILES.

Corolla with throat much inflated and only slightly two-ridged within anteriorly. Sepals acuminate, more than one half length of capsule. Sterile filament moderately bearded.

Anthers barbate. Corolla 25-35 mm. long, more strongly inflated, white or slightly tinged or lined with purple. Stem glabrous or nearly so, semi-shining. 11. *P. digitalis*.

Anthers glabrous. Corolla smaller, moderately inflated, more or less violet-purple. Stem finely pubescent to glabrous, relatively dull.

Corolla 20-25 mm. long, usually light violet-purple. Inflorescence narrower than long, in fruit 2-6 cm. wide, its cyme-branches of but two or three nodes. Stem-leaves mostly oblong-lanceolate, relatively less expanded at base, less serrate.

12. *P. pentstemon*.

Corolla 15-20 mm. long, violet-pink, paler within. Inflorescence in fruit usually 6-12 cm. wide, its cyme-branches of repeated nodes. Stem-leaves usually much smaller, often somewhat expanded at base, more sharply serrate.

13. *P. tenuis*.

Corolla with throat narrow, strongly two-ridged within anteriorly. Sepals acute or triangular-acuminate, less than or nearly one half length of mature capsule.

Corolla 15-17 mm. long, white, its throat about as long as the tube, the orifice not closed by the anterior lip. Sterile filament moderately bearded. Leaves below inflorescence relatively well-developed, so stem conspicuously leafy.

Free portions of posterior lobes of corolla upcurved. Inflorescence 4-7 cm. wide. Stems puberulent or pubescent. Basal leaves 7-10 cm. long, obtuse to acute, crenate-serrate, the stem-leaves obtusish to acuminate, all puberulent. Plants forming small clumps of few stems.

Stem grayish-puberulent.

14. *P. arkansanus*.

Stem pubescent. Stem-leaves broader, nearly ovate. 14a. *P. arkansanus pubescens*.

Free portions of posterior lobes of corolla upcurving-reflexed. Inflorescence 6-12 cm. wide. Stems obscurely puberulent. Basal leaves 12-18 cm. long, acuminate, sharply serrate, the stem-leaves acuminate-attenuate, all glabrous. Plants forming large clumps, of very many stems.

15. *P. multicaulis*.

Corolla 20-30 mm. long, pinkish- or purplish-white, its throat longer than the tube, the orifice somewhat closed by the anterior lip which upcurves as an arc. Sterile filament densely bearded. Leaves just below inflorescence tending to be much reduced, so stem less "leafy."

16. *P. pauciflorus*.

CC. Leaf-blades filiform, less than 1 mm. wide. Corolla 15-20 mm. long, its throat decurved, narrow, not inflated. Sterile filament glabrous. Plant not forming winter rosettes, the bases of the stems perennial. VI. AMBIGUI.

17. *P. ambiguus*.

AA. Anther-cells pendulous (so anthers tend to be horseshoe-shaped), opening partially by proximal slits (which extend over two thirds length of sac). Leaves coriaceous, all sessile, and the lower cauline leaves persistent on the perennial bases of the stems. Corolla deep-carmine, its posterior lobes projecting, the anterior recurved. (*Saccanthera*.) VII. BACCHARIFOLII.

18. *P. baccharifolius*.

1. *Penstemon murrayanus* Hook.

Penstemon murrayanus Hook., in Bot. Mag. 63: pl. 3472. 1836. "A native of San Felipe, in Texas: discovered by Mr. Drummond, in 1834." Grown in the Glasgow Botanic Garden. Drummond, Coll. II, 292, from which collection the seeds for culture were likely obtained, seen in Herb. Columbia University at the New York Botanical Garden.

Sand, open woods or prairies, through the short-leaf pineland of eastern Texas, westward locally in the cross-timbers (oak-woods) and coast prairie; from southwestern Arkansas to San Augustine, Refugio and Milam counties, Texas. Flowering from late April to mid-June.

ARKANSAS. —: Fort Towson, Leavenworth (A, Y).

TEXAS. Ellis: Ennis, Hogan (U). Gregg: Gladewater, Reverchon 2542 (M, U). Houston: Grapeland, Tharp (T, Y). Milam: Milano, E. J. Palmer 11661 (M). Refugio: Refugio, E. J. Palmer 9119 (M). San Augustine: San Augustine, E. J. Palmer 9512 (M). Smith: Swan, Reverchon 3221 (M, U, Y). Waller: Hempstead, Hall 409 (U, Y).

2. *Penstemon grandiflorus* Nutt.

Penstemon grandiflorus Nutt. in Fraser's Cat. 1813. "It was first met with near the confluence of the River Platte [with the Missouri] from whence it continues to the Andes [Nuttall]." Probable isotype seen in Herbarium of the Academy of Natural Sciences of Philadelphia.

Sandy prairies and open woodland, western Oklahoma, south to central Texas; Lower Sonoran Zone (at altitudes of 1,500 to 2,000 feet). Ranges through the Plains from Wisconsin and North Dakota to Wyoming and Texas. Flowering in late April and May.

OKLAHOMA. Probably on False Washita, between Fort Cobb and Fort Arbuckle, *E. Palmer* 226 (U, Y).

TEXAS. Callahan: Baird (sandy woods, west of B), Reverchon 1342 (M). Gillespie: Sandy Creek, Jermy 280 (M).

3. *Penstemon buckleyi* Pennell, sp. nov.

Penstemon amplexicaulis Buckley, in Proc. Acad. Nat. Sci. Phila. 1861: 461. 1862. "About 60 miles N. E. of Camp Colorado [Texas, *S. B. Buckley*] June [1861]." Camp Colorado, as I am informed by Mr. B. C. Tharp of the University of Texas, "was in Coleman County about fifteen miles northwest of the present town of Coleman." "About 60 miles northeast of" this point would reach Sandy Creek in Stephens County, and it was doubtless in a sand-region that Buckley found his plant. His description must be modified to denote a plant with sterile filament moderately bearded [not "glabro"] and with anthers glabrous [not "piloso-lanatis"]. Type seen in the Herb. of the Academy of Natural Sciences of Philadelphia, and these discrepancies verified and corrected. Not *P. amplexicaulis* Moench, Meth. 442. 1794.

Corolla pale-lavender, with lavender-violet lines within on anterior side. Flowering in May and early June.

Dry sandy soil, sand-hills of western Oklahoma and northwestern Texas; Lower Sonoran Zone (at altitudes of 1,700 to 2,400 feet). Ranges from southwestern Kansas to Taylor, and Ward counties, Texas.

OKLAHOMA. Beckham: Sayre, Pennell 10553 (M, Y), 10560 (A, C, H, J, K, L, M, O, P, S, T, U, Y), 10565 (U, Y). Woodward: Woodward, Eggert (M).

TEXAS. Hemphill: Canadian, Eggert (M), *E. J. Palmer* 14121 (M). (?) Stephens: —, Buckley (A). Taylor: Abilene, Eggert (M). Ward: Monahans, Clawson 13907 (U). Wheeler: (observed by Pennell).

4. *Penstemon angustifolius* Nutt.

Penstemon angustifolius Nutt. [in Fraser's Cat. 1813, nomen nudum; Pursh, Fl. Am. Sept. 738. 1814. "In upper Louisiana, Bradbury. . . . v.s. in herb. Bradbury." According to Bradbury (Travels, 318) this was collected "near the Mintaree village," in what is now North Dakota. Isotype, collected by Bradbury in "Louisiana," seen in Herb. Academy of Natural Sciences.

Penstemon coeruleus Nutt., Gen. Pl. 2: 52. 1818. "Hab. on the plains of the Missouri, near Fort Mandan and the Indian towns," North Dakota.

Our species would be *P. angustifolius caudatus* (Heller) Rydb., but that seems to be too inconstantly distinguishable to be considered as more than a form.⁶

Corolla coerulean-blue, with violet-pink lines within on anterior side. Flowering in May.

Sandy prairies, extreme northwestern ("Panhandle" region of) Oklahoma; Upper Sonoran Zone (at altitudes above 3,000 feet). Ranges through the High Plains from North Dakota and eastern Wyoming to northwestern Oklahoma and northern New Mexico.

OKLAHOMA. Beaver: Knowles, Stevens 323 (M, U). Cimmaron: Doby, Stevens 508 (M, U).

5. *Penstemon fendleri* Torr. & Gray.

Penstemon fendleri T. & G., in Pacific Rail. Rep. 2. 4: 168. pl. 5. 1855. On "the Pecos and Llano Estacado [Texas, Dr. W. L. Diffenderfer on Pope's Expedition]." Type not seen, but description and illustration distinctive.

Corolla blue, pinkish on tube externally, with sharply defined violet-pink lines internally on both posterior and anterior lobes. Flowering in April and May.

Sandy or gravelly loam, frequently over limestone, on plains or bluffs, most common on the Staked Plains of northwestern Texas, entering extreme western Oklahoma, and crossing the escarpment southward to Menard and Tom Green Counties, Texas; chiefly Upper Sonoran Zone (at altitudes above 1,600 feet). Also in eastern New Mexico.

OKLAHOMA. Beaver: —, Stevens 352 (M, U).

TEXAS. Fisher: Grady, Shepherd (U). Garza: Post, Pennell 10533 (M, T, Y). Hale: Hale Center, — (T). Hall: Estelline, Reverchon (M). Martin: Stanton, Eggert (M). Menard: Menard, E. J. Palmer 11881 (M). Mitchell: Colorado, E. J. Palmer 13796 (M). Nolan: Sweetwater, E. J. Palmer 13736 (M). Potter: Ady, Pennell 10547 (A, M, T, U, Y). Randall: Canyon, Pennell 10540 (Y), 10540 (C, H, O, P, U, Y). Runnels: Ballinger, Pennell 10509 (T, Y). Swisher: Tulia, Pennell 10538 (A, C, H, J, J, L, M, O, S, T, U, Y). Tom Green: San Angelo, Pennell 10486 (A, C, H, K, M, T, U, Y).

6. *Penstemon albidus* Nutt.

Penstemon albidus Nutt., Gen. Pl. N. Am. 2: 53. 1818. "Hab. On the plains of the Missouri, common, from the confluence of the River Platte to the Mountains." Type seen in Herb. Academy of Natural Sciences of Philadelphia.

⁶ See discussion in Contrib. U. S. Nat. Herb. 20: 362. 1920.

Corolla violet-white, with many fine violet lines within throat on anterior side. Flowering from early May to early June.

Sandy or gravelly loam (frequently calcareous), on bluffs, low hills or prairies, western Oklahoma and northwestern Texas; chiefly Upper Sonoran Zone (at altitudes above 1,800 feet). Ranges through the High Plains from Manitoba and Montana to northwestern Texas.

OKLAHOMA. Beaver: Stevens 353 (M, U). (Beckham: observed by Pennell). Harper: Buffalo, Stevens 304 (M, U). Woodward: Woodward, Eggert (M).

TEXAS. Armstrong: Gamble's Ranch, E. J. Palmer 13906 (M). Garza: Post, Pennell 10530 (A, C, H, J, K, L, M, S, T, U, Y). Potter: Ady, Pennell 10549 (A, O, T, Y), Amarillo. Randall: Canyon, Pennell 10545 (C, H, M, P, T, U, Y).

7. *Penstemon guadalupensis* Heller.

Penstemon guadalupensis Heller, in Contrib. Herb. Franklin & Marshall Coll. 1: 92. pl. 7. 1895. "Very plentiful in dry, stony ground along the Guadalupe and Town Creek [near Kerrville, Texas], altitude 1600-1650 feet, April 19, [1894, A. A. Heller] 1609." Isotype seen in herbarium of Academy of Natural Sciences, etc.

"Corolla white or sometimes faintly tinged with purple." Flowering in April and May.

Sandy, gravelly or rocky open loam or clay, probably calcareous, Edwards Plateau, Concho and Lampasas counties; Lower Sonoran Zone (at altitudes from 1,300 to 2,200 feet). From Howard and Comanche to Kerr Counties, central Texas.

TEXAS. Brown: —, Reverchon 698 (M, U). Comanche: Comanche, Eggert (M). Gillespie: Fredericksburg, Bray 291 (T, U); Pedernales. Howard: Big Spring, Eggert (M). Kerr: Kerrville, Heller 1609 (A, M, U, Y). Nolan: Sweetwater, E. J. Palmer 13735 (M).

8. *Penstemon triflorus* Heller.

Penstemon triflorus Heller, in Contrib. Herb. Franklin and Marshall Coll. 1: 92. pl. 8. 1895. "Found only along the summit of one hill northeast of Kerrville [Texas], altitude 2000 feet . . . April 26 [1894], [A. A. Heller] (1654)." Isotypes seen in the herbaria of the Academy of Natural Sciences, etc.

Penstemon helleri Small, in Bull. Torr. Bot. Club 25: 471. 1898. "These specimens [Heller 1610] form the type . . . The original specimens are from Kerrville, Kerry County, Texas, collected in April and June, 1894." Type collected April 19, 1894, seen in the Herbarium of Columbia University at the New York Botanical Garden.

Plants very variable, apparently tending to two types, which are

predominantly plants of open or of shade. Both however, are frequently intermixed. One has corolla white or pale-pink, with relatively wider throat, the pedicels and peduncles shorter so that the thyrsus is more congested, and the leaves broader; this, the prevalent form, is the plant called by Heller *P. cobaea* and by Small *P. helleri*. The other has corolla darker, frequently bright pink-red, with narrower throat more glandular within, the peduncles and often fewer pedicels longer so that the thyrsus is more lax, and the leaves frequently narrower; this would be typical *P. triflorus*. In both the corolla has conspicuous deeper pink lines, especially on the anterior side. However, field-study convinces me that no real distinction of these trends can be made. All are well shown in my series from Kerrville, Texas. Flowering from March to May.

Thin calcareous loam, gravelly or rocky places, common on the hills of the Edwards Plateau, less frequent in the Lampasas and Concho countries; lower Sonoran Zone (at altitudes from 500 to 2,000 feet). From Lampasas and Tom Green to Bexar and Valverde Counties, central Texas.

TEXAS. Bexar: Beckmann, Pennell 10407 (T, Y); Camp Stanley Inc., Pennell 10409 (Y). Burnet: Marble Falls, Bray 109 (Y). Cooleman: Talpa, Pennell 10515 (Y). Comal: Bracken, Groth 23 (U). Crockett: Ozona to Devils River, Hanson 516⁷ (U, Y). Gillespie: Half-Moon Mt., Jermy 830 (M). Kendall: Boerne, Pennell 10415 (O, Y). Kerr: Kerrville, Heller 1610 (A, M, U, Y), 1654 (A, U, Y), Pennell 10377 (A, H, M, U, Y), 10380 (C, J, L, Y), 10382 (Y), 10397 (Y), 10398 (Y), 10399 (Y), 10400 (K, Y), 10402 (T, Y); Lacey's Ranch; Turtle Creek. Menard, Menard, E. J. Palmer 11865 (M). Real: Leahey, Lea (U) Tom Green: San Angelo, Pennell 10500 (A, C, H, M, T, U, Y). Travis: Glen Rose, Hill (U). Uvalde: Con Can, Sabinal, E. J. Palmer 10221 (Y).

9. *Penstemon cobaea* Nutt.

Penstemon cobaea Nutt., in Trans. Am. Phil. Soc. II. 5: 182. 1837. "Hab. In the sterile and denudated portions of the prairies of Red River [Arkansas Territory], in calcareous soil." Type seen in Herb. Academy of Natural Sciences of Philadelphia.

Corolla white or pale violet-purple, irregularly lined with violet; probably frequently somewhat darker, as the type is described as "bluish-purple." Flowering in April and May.

⁷ Corolla also with short hairs on the anterior side.

Black or red loam, usually calcareous, central and western prairies of Oklahoma, on Abilene and Lampasas plains, Grand and especially the Black Prairie, south to Bexar County, central Texas; also in post-oak woods eastward in Waller County; Austroriparian and Lower Sonoran Zones (at altitudes of 300 to 2,000 feet). Central Plains of Oklahoma and Texas, south to Bexar County. Ranges north to Kansas, and, including the following variety, into the Ozark Mountains of southern Missouri and Arkansas.

OKLAHOMA. Cleveland: Norman, Emig 485 (M). Custer: Weatherford, Pennell 10572 (A, C, H, J, K, L, M, O, P, S, T, U, Y). Woods: Cora, Stevens 539 (M, U).

TEXAS. Bexar: San Antonio, Thurber (Y). Comal: New Braunfels, Pilsbry (A). Comanche: Comanche, Eggert (M). Dallas: Dallas, Pennell 5402 (P, Y). Grayson: Denison, Letterman (M); Sherman. Hays: San Marcos, Stanfield (Y). Hood: Granbury, Eggert (M). Kaufman: Terrell, Tyler (U). McLennan: Waco, Griffith (Y). Medina: Hondo, Pilsbry (A). San Augustine: San Augustine, Leavenworth (A). Shackelford:—, Holstein. Tarrant: Fort Worth, Ruth 101 (M, U, Y). Taylor: Buffalo Gap, Havard (U). Travis: Austin, Pennell 10448 (U, Y). Waller: Hempstead Hall 408 (M U Y). Wichita: Burkburnett Tharp 522 (Y).

9a. *Penstemon cobaea purpureus* Pennell, var. nov.

Corolla 38–43 mm. long, less inflated, violet-purple and with dark violet lines; evidently glandular-pubescent within. Plant 10–12 dm. tall. Leaves usually longer, 10–15 cm. long, dark green.

Type, limestone cliffs, Penters Bluff, Izard Co., Arkansas, collected in flower June 1, 1920, F. W. Pennell 10681, in the Herbarium of the New York Botanical Garden.

Here considered as a geographic variety of the prairie species, *Penstemon cobaea*, but further field-study is needed to decide their mutual status. A strikingly distinct plant, when contrasted alive with the paler-flowered species, but specimens of the latter show great range of variation in most features. Flowering in May and June.

Rocky calcareous barrens and cliffs, Ozark Mountains of northern Arkansas and southern Missouri.

ARKANSAS. Izard: Penters Bluff, Pennell 10681 (A, C, H, K, L, M, O, T, U, Y). Marion: Cotter, E. J. Palmer 14320 (M).

10. *Penstemon tubiflorus* Nutt.

Penstemon tubiflorus Nutt., in Trans. Am. Phil. Soc. II. 5: 181. 1837. "Hab. In wetish prairies, from Forth Smith to Red River [Arkansas Territory. T. Nuttall]." Type seen in Herb. of the Academy of Natural Sciences of Philadelphia. Description of corolla as villose within is difficult to account for, otherwise our plant is certainly described.

Corolla white throughout. Flowering in late May and early June.

Sandy or light loam, deciduous or mixed woodland in the Ozark-Ouachita Mountains and hills of Arkansas and eastern Oklahoma, and on prairies in eastern Oklahoma. The plants seen from the Ozarks of Arkansas have habitually a laxer thyrus and slightly smaller corollas than have those from the prairies and woods of Oklahoma. Also in Ozarks of southern Missouri.

ARKANSAS. Madison: Pettigrew, Howell 671 (U). Pope: Russellville, Pennell 10628 (H, M, Y). Pulaski: Little Rock, Pennell 10643 (A, C, H, J, K, L, M, O, P, S, T, U, Y). Sebastian: Fort Smith, Bigelow (U, Y). Washington: Fayetteville, Harvey (M).

OKLAHOMA. Creek: Sapulpa, Bush 1199 (M, Y). McCurtain: Shawneetown, Houghton 3889 (Y). Pittsburg: McAlester, Pennell 10595 (A, C, H, J, K, M, O, S, T, U, Y). Wagoner: Wagoner, Pennell 10610 (A, M, U, Y).

TEXAS. Bowie: Texarkana, Heller 4169 (Y).

11. *Penstemon digitalis* Nutt.

Penstemon digitalis Nutt.; Sims, in Bot. Mag. 52: pl. 2587. Aug. [1], 1825. "Communicated by Robert Barclay, . . . to whom the seeds were sent by Professor Nuttall, in March 1824, under the name which we have adopted. Native of the Arkansas territory." Careful description and illustration given. Later, independently redescribed by Nuttall himself in Trans. Am. Phil. Soc. II. 5: 181. 1837.

Chelone digitalis (Nutt.) Sweet, Brit. Fl. Gard. pl. 120. Aug. 1, 1825. "*Penstemon Digitalis* Nutt. Found by Mr. Nuttall in the Arkansas territory of North America. The plant from which our drawing was taken was received last autumn from New York, by Mr. Anderson, of the Apothecaries' Garden at Chelsea, to whom it was sent by Mr. Hogg." A careful description and illustration certainly of the plant now considered, the description being apparently more accurate than Nuttall's own, or that of Sims, in mentioning the pubescence of the anthers.

Corolla, westward, white or externally slightly purplish; eastward the corolla tends to be smaller, more purplish-tinged and with fine violet lines within throat. Flowering from mid-April to early June, depending upon latitude.

Loam or sandy soil, open woodlands, meadows and prairies; through the Ozark-Ouachita highland of Arkansas and southeastern Oklahoma; thence entering surrounding lowland, cleared Mississippian bottomland of northeastern Arkansas, fields and prairies of

northeastern Texas, etc. Native also in southern Missouri and widely introduced northeastward to the Atlantic states.

ARKANSAS. Clay: Corning, Eggert (M, Y). Izard: Guion, Pennell 10687 (Y). Jefferson: Kearney, Pennell 10657 (C, Y). Nevada: Prescott, Hollister (U). Pope: Russellville, Pennell 10, 633 (H, M, U, Y). Pulaski: Little Rock, Pennell 10650 (A, L, Y). Washington: Fayetteville, F. L. Harvey (M).

OKLAHOMA. McCurtain: Idabel, Stevens 3623 (U). Pittsburg: McAlester, Pennell 10589 (K, O, S, T, U, Y).

LOUISIANA. Caddo: Shreveport, Cocks (L). Natchitoches: Natchitoches, E. J. Palmer 7503 (M).

TEXAS. Bowie: Texarkana, Heller 4169 p. p. (A, U). Dallas: Dallas, Reverchon 3220 (Y). Tom Green: San Angelo, Reverchon 3933 (M). Van Zandt: Grand Saline, Reverchon 3934 (M).

12. ***Penstemon pentstemon*** (L.) MacM.

Chelone pentstemon L., Sp. Pl. 612. 1753. "Habitat in Virginia." Type not verified, but must have been the species now considered, because in 1753 this was certainly the only essentially glabrous species of the Atlantic seaboard.

Penstemon laevigatus Ait., Hort. Kew. 2: 361. 1789. "*Chelone Pentstemon* J. F. Miller ic. 4 . . . Nat. of North America. Cult. 1776, by John Fothergill, M. D." The description, and also the plate of Miller, clearly denote the species now considered.

Bartramia pulchella Salisb., Prod. Stirp. Chapel Allerton 99. 1796. New name for *Penstemon laevigatus* Ait. Type of genus *Bartramia* Salisb.

Penstemon pentstemon (L.) MacM., in Bull. Torr. Bot. Club. 19: 15. 1892.

Corolla externally violet-purplish, deepest on tube, on throat and lobes pale-purplish, nearly white on anterior side; within white, and within throat on anterior side with more or less evident violet lines. Sterile filament with yellow hairs. Flowering in May.

Meadows, or more rarely open pine-woods, pineland of central Louisiana. From Virginia to northern Florida and Louisiana, inland through the eastern Mississippi Valley to Indiana.

ARKANSAS. Hempstead: Fulton (low woods), E. J. Palmer 5418 (M).

LOUISIANA. Rapides: Alexandria, (dry pine-woods), Ball 616 (M, Y).

13. ***Penstemon tenuis*** Small.

Penstemon tenuis Small, Fl. S. E. Un. St. 1061, 1337. 1903. "Type, La., Hale, Apr., in Herb. C. U." Type, from "fertile soils," Louisiana, seen in the Herbarium of Columbia University at the New York Botanical Garden.

Corolla violet-pink externally, within paler, with or without

deep-violet lines. Flowering from early April to early June, depending upon latitude.

Heavy loam, swales and low woodland, mostly in alluvial soil, along the bottomlands of the lower Mississippi valley north to northeastern Arkansas, and also westward near the Gulf coast to the Brazos River, Texas. Near sea-level in Louisiana, Arkansas, and Texas; seen from east of the Mississippi River only from Tangipahoa Parish, Louisiana.

ARKANSAS. Hempstead: Fulton, E. J. Palmer 10514 (M). Independence: Newark, Pennell 10699 (A, C, H, J, K, M, U, Y). Miller: Mandeville, Eggert (M). Pulaski: Little Rock, Hasse (Y).

LOUISIANA. Acadia: Crowley, Pennell 10186 (A, H, L, S, U, Y). Rapides: Alexandria, Ball 654 (M).

TEXAS. Brazoria: Brazoria; Columbia, Bush 115 (M, Y). Fort Bend: Richmond, Bray 79 (T, U). Harris: Houston, Pennell 10258 (T, Y). Liberty: Liberty, E. J. Palmer 7727 (M), 9598 (M).

14. ***Penstemon arkansanus*** Pennell, sp. nov.

Stems clustered, several from a clump, 3-6 dm. tall, grayish-puberulent over entire surface, often purple. Leaves membranous, slightly paler beneath, finely puberulent on both surfaces; the lowest narrowed to petiole-like bases, the longest 7-10 cm. long, obtuse to acute, crenate-serrate; the upper lanceolate, acutish to acuminate, somewhat serrate; the bracts much reduced. Thyrsus less than one half the height of the plant, longer than wide, of 3-9 fascicles, each of two axillary branches which repeatedly branch cymosely, the pedicels much shorter than the primary peduncle. Sepals in anthesis 2-3 mm. long, in fruit 4-5 mm. long, ovate, acute to acuminate, obscurely scarious-margined, glandular-pubescent. Corolla 15-17 mm. long, the tube and throat 11-12 mm. long, the throat narrow, slightly inflated, two-ridged within distally on anterior side, the orifice open; the two posterior lobes 2-2.5 mm. long, united over one half length, their free portions upcurved-spreading; the three anterior lobes 4-5 mm. long, united at base; the corolla externally finely glandular-pubescent, internally slightly pubescent over bases of anterior lobes; white, on anterior side with violet lines. Anther-cells divaricate, oblong, dark-violet, .6-.7 mm. long, glabrous, opening throughout. Sterile filament slightly exserted, flat, not wider distally, moderately bearded distally with yellow hairs. Capsule at least 6-7 mm. long, ovate-acuminate in outline, glabrous, not seen mature.

Type, shale and sandstone woods, Pulaski Heights above Little Rock, Pulaski County, Arkansas, collected in flower and young

fruit May 31, 1920, F. W. Pennell 10640; in Herbarium of the New York Botanical Garden.

This was the plant called "*Penstemon levigatum*" by Nuttall in his Flora of Arkansas.

Near *Penstemon pallidus* Small, a species which has softly pubescent leaves and more acuminate sepals.

Thin rocky or sandy soil, shale or sandstone, Ozark and Ouachita mountains and hills of Arkansas and southeastern Oklahoma. Flowering in late April and May.

ARKANSAS. Carroll: Beaver; Eureka Springs, Bush 1522 (M). Garland: Hot Springs, Foreman (U). Pope: Russellville, Pennell 10629 (M, Y). Pulaski: Little Rock, Pennell 10640 (A, C, H, J, K, L, M, S, T, U, Y), 10651 (A, C, H, O, P, U, Y).

OKLAHOMA. Leflore: Page, Stevens 1374 (M, U).

14a. *Penstemon arkansanus pubescens* Pennell, n. var.

Stem 4-7 dm. tall, pubescent with fine glandless hairs, and also somewhat hirsute with spreading mostly gland-tipped hairs. Stem-leaves 20-40 mm. wide, nearly ovate, acuminate, serrate, pubescent beneath on the principal veins. Inflorescence as in the species.

Type, sandstone woodland, Penters Bluff, Izard County, Arkansas, collected in late flower and young fruit, June 1, 1920, F. W. Pennell 10679; in Herbarium of the New York Botanical Garden.

On sandstone and limestone, Izard county, Arkansas; probably through northern Ozarks of northern Arkansas and southern Missouri.

ARKANSAS. Izard: Guion (limestone cliff), Pennell 10685 (A, Y), (sandstone cliff), Pennell 10690 (Y); Penters Bluff (sandstone woodland), Pennell 10679 (H, M, U, Y).

15. *Penstemon multicaulis* Pennell, sp. nov.

Stems many from a clump, 4-7 dm. tall, obscurely puberulent; often purplish. Leaves membranous, slightly paler beneath, glabrous on both surfaces; the lowest narrowed to petiole-like bases, the longest 12-18 cm. long, acuminate, sharply serrate; the upper lanceolate, mostly attenuate-acuminate, serrate; the bracts much reduced. Thyrsus less than half the height of the plant, little longer than wide, of 6-9 fascicles, each of two axillary branches which repeatedly branch cymosely, the pedicels much shorter than the long primary and secondary peduncles. Sepals in anthesis 3-4 mm. long, in fruit 5-6 mm. long, ovate-acuminate, obscurely scarious margined, glandular-pubescent. Corolla 15-17 mm. long, the tube and throat 11-12 mm. long, the throat narrow, slightly inflated,

two-ridged within on anterior side, the orifice open; the two posterior lobes 2-2.5 mm. long, united about one half length, their free portions upcurved-reflexed; the three anterior lobes 4-5 mm. long, united at base; the corolla externally finely glandular-pubescent, internally slightly pubescent over bases of anterior lobes; white, within throat, especially median to each lobe, with a few violet lines. Anther-cells divaricate, oblong, intensely violet, .5-.6 mm. long, glabrous, opening throughout. Sterile filament slightly exerted, flat, not wider distally, moderately bearded distally with yellowish hairs. Capsule at least 6 mm. long, ovate-acuminate in outline, glabrous, not seen mature.

Type, sandstone and shale cliffs, Ozark, Franklin County, Arkansas, collected in flower May 29, 1920, F. W. Pennell 10616; in the Herbarium of the New York Botanical Garden.

Along river cliffs in southern Ozarks of western Arkansas. Distribution should be studied, and constancy of characters of distinction from *P. arkansanus* noted. These seem to be well-marked.

ARKANSAS. Franklin: Ozark, E. J. Palmer 8143 (M), Pennell 10616 (A, C, H, J, K, L, M, O, P, S, T, U, Y). Also seen from Frisco Springs, "Northwest Arkansas," Wells 49 (U).

16. *Penstemon pauciflorus* Buckley.

Penstemon pauciflorus Buckley, in Proc. Acad. Nat. Sci. Phila. 1861: 461. 1862. "Past [= Post] oak woods south of Fort Belknap, [Texas, S. B. Buckley, May, 1860-61]." Fort Belknap was in Young County on the Brazos. The description inapplicable to any *Penstemon*, and at variance with the plant to which the name is now applied in these points: segments *linear-subulate*, corolla-tube constricted to *scarcely a line* in width and sterile filament *glabrous* with ciliated apex. Fortunately, Dr. A. Gray had seen Buckley's material in the two collections to which he sent specimens, the herbarium of the Philadelphia Academy, and that of Elias Durand. In his criticism of Buckley's proposed species [in Proc. Acad. Sci. Phila. 1862: 165. 1863] he tells us that Buckley confused, with a genuine *Penstemon*, *Phlox pilosa* L., and that most of the description applies to the latter! Also that the *Penstemon*, "a slender form of *P. pubescens*," has a sterile filament "heavily bearded," a feature particularly true of the present species. The specific name should certainly apply to the *Penstemon* component. As there appears to be but one species of this genus characteristic of post-oak woods in Texas, and that one has these features, the *Penstemon* element of Buckley could scarcely fail to have been the plant now considered. As no *Penstemon* was supplied to the Academy herbarium the type must be the plant of the Durand Herbarium, but either this admixture was culled out by Durand from his material, which is now in the Herbarium of the Academy of Natural Sciences of Philadelphia, or else it is included in the portion of his herbarium which went to Paris. Accordingly it seems best to redescribe the species.

Stems scarcely clustered, frequently but one from a root, slender, 3-7 dm. tall, minutely pubescent over entire surface, green or purplish. Leaves membranous, green, slightly paler beneath, finely pubescent to nearly glabrous; the lowest narrowed to petiole-like bases, the longest ovate to oblong, 3-10 cm. long, obtuse, crenate-

serrate, the upper lanceolate or oblong-lanceolate, obtuse or obtusish, serrate; the bracts much reduced. Thyrsus about one third the height of the plant, longer than wide, of 3-6 fascicles, each of two axillary branches, which cymosely branch 2-3 times, rarely more, the pedicels shorter than the primary peduncle. Sepals in anthesis 2-6 mm. long, in fruit 3-7 mm. long, oblong-ovate to ovate, acute to acuminate, slightly or not scarious margined, glandular-pubescent. Corolla 20-28 mm. long; the tube and throat 15-20 mm. long, the throat narrow, slightly inflated, strongly two-ridged within on anterior side, the orifice nearly closed by the up-curved base of the anterior lip; the two posterior lobes 3-5 mm. long, united and arched less than or about one half length, their free portions spreading; the three anterior lobes 5-8 mm. long, united at base; the corolla externally finely glandular-pubescent, internally slightly pubescent over the base of the anterior lobes; whitish or purplish-white, on anterior side with fine violet lines. Anther-cells divaricate, oblong, violet, 8. mm. long, microscopically puberulent, opening throughout. Sterile filament slightly exerted, flat, not wider distally, densely bearded with deep-yellow, becoming brownish-yellow hairs. Capsule 8-10 mm. long, ovate-acuminate in outline, glabrous, brown. Seeds .8-.1 mm long, sharply and slightly wing-angled; testa brown lustrous, reticulate.

Plants of coastal plain, especially in pineland and coast prairie, smaller-leaved and with stem nearly bare, while upland plants are rather leafy. Also upland plants, especially in eastern Oklahoma, are relatively more pubescent.

Sandy soil, usually open woodland or prairie, through the Coastal Plain south of the Arkansas River in Arkansas and west to the Guadalupe River in Texas, in long-leaf pineland, short-leaf pineland, coastal prairie and post-oak woods; inland in sandy or rocky woods or prairies to the Burnet metamorphic country of central Texas, and northwestward (west of the higher Ouachita Hills) to central Oklahoma. Flowering from early April to early June, depending upon latitude.

ARKANSAS. Jefferson: Jefferson Springs, Pennell 10658 (A, C, H, M, U, Y).

OKLAHOMA. Atoka: Limestone Gap, Butler 106 (M). Caddo: Hinton, Stevens 943 (M, U). Creek: Sapulpa, Bush 881 (M, Y). Lincoln: Fonts, Neaves (U). Logan: Guthrie, Carleton 147 (U). McCurtain: Idabel, Houghton 3629 (M, Y). Muskogee: Muskogee, Oyster (U). Oklahoma: Bethany, Pennell 10576 (H, K, O, P, Y). Payne: Stillwater, Waugh 253 (U). Pittsburg: McAlester, Pennell 10586 (A, C, M, Y).

LOUISIANA. Acadia: Crowley, Cocks (L). Caddo: Shreveport, Cocks 3612 (L, Y). Calcasieu: DeQuincy, Pennell 10228 (L, T, U, Y); Lake Charles, Pennell 10220 (Y). Jeff Davis: Jennings, Pennell 10206 (A, C, H, J, K, L, M, S, U, Y). Natchitoches: Natchitoches, E. J. Palmer 7305 (M). Rapides: Alexandria, Hale (U).

TEXAS. Austin: Bellville, Pennell 10301 (T, Y). Brazoria: Alvin, Young 257 (T). Burnet: Fairland, Pennell 10478 (Y). Dallas: Dallas, Reverchon 694 (M). Fayette: Colony, Crawford (M). Guadalupe: Kingsbury, E. J. Palmer 11643 (M). Hardin: Fletcher, E. J. Palmer 9549 (M). Harris: Harrisburg, Pennell 10250 (Y); Houston. Hays: San Marcos, Stanfield (Y). Hood: Granbury, Eggert (M). Jackson: Ganado, E. J. Palmer 9241 (M). Liberty: Dolen, Young (T). Milam: Milano, E. J. Palmer 11775 (M). Orange: Orange, Bray 56 (U). Polk: Livingston, E. J. Palmer 5212 (M). San Augustine: San Augustine, Crocket (U). Smith: Troup, Young (T). Tarrant: Handley, Ruth 462 (U). Travis: Austin, Pennell 10443 (Y). Victoria: Mission Valley, Schott (Y). Walker: Huntsville, Young (T).

17. *Penstemon ambiguus* Torr.

Penstemon ambiguus Torr., in Ann. Lyc. N. Y. 2: 228. 1828. "Hab. Near the Rocky Mountains [E. P. James in 1820]." Type collected by Edwin James either in eastern Colorado, northeastern New Mexico or northwestern Texas, seen in Herb. of Columbia University at the New York Botanical Garden.

Leiostemon purpureus Raf., Atl. Jour. 1: 145. 1832. Based upon *Penstemon ambiguus* Torr.

Sandy or rocky prairies, mostly near streams; plains north of Canadian River in extreme northwestern Texas; in the Wichita Mountains, southwestern Oklahoma; and in the western Callahan Divide, west-central Texas; doubtless elsewhere in upland Texas; Upper Sonoran Zone (at altitudes above 2,400 feet). High plains, westward to southwestern Utah and Chihuahua. Flowering from May to August.

OKLAHOMA. Comanche: Wichita Mts., Marcy (Y).

TEXAS. Dallam; Texline, Howell 138 (U). Hartley: Channing, E. J. Palmer 14157 (M). Howard: Big Springs, Tracy 7995 (M, T, Y). Martin: Stanton, Eggert (M). Ward: Monahans, Clawson 13909 (U).

18. *Penstemon baccharifolius* Hook.

Penstemon baccharifolius Hook., in Bot. Mag. 78: pl. 4627. 1852. "Rear-
ed from Texian seeds gathered by Dr. Wright." Specimen collected by
C. Wright in 1851-52, but with exact data lost, seen in Herbarium of Col-
umbia University. This must be either his 439 or 1479, both credited
by A. Gray in Torr., Bot. Mex. Bound. 114. 1859, as collected on "rocky
bluffs at the Big Bend of the San Pedro River, Texas." Evidently the
type station.

Limestone ledges, bluffs and canyons, in Edwards and Uvalde
Counties, Texas; and Rio Grande portion of Lower Sonoran Zone
(at altitudes of 1,000 to 1,500 feet). Ranges westward through
Trans-Pecos Texas. Flowering from April to June.

TEXAS. Edwards: Barksdale, E. J. Palmer 11009 (M), 12337
(M). Uvalde: Montell, E. J. Palmer 12323 (M). Valverde:
Viaduct, Pilsbry (A).

Penstemon atropurpureus Raf., Atl. Jour. 1: 176. 1833 [not *P.*
atropurpureus (Sweet) G. Don 1830], said to be from Texas or
"Arkansas," to be represented by a specimen or specimens in
Rafinesque's herbarium and to have been seen living by him, is
described as with leaves "ang. lanc. amplexic. serrul. glabr.
acutissim." and flowers "small, dark purple." Probably two
species are confused, but I can identify neither as Texan.

16. *SCROPHULARIA* Linné.

Scrophularia L., Sp. Pl. 619. 1753.

Type species, *S. nodosa* L., of Europe.

Sterile filament greenish-yellow, 1.8 mm. wide. Corolla 8-12 mm.
long. Calyx-lobes acute or acutish. Capsule pyramidal-acum-
inate, 5-10 mm. long. Seeds .8-1 mm. long. Inflorescence
narrowly elongated, 4-8 cm. wide, its branches relatively stout.
Leaf-blades cuneate to truncate at base, coarsely serrate to
incised. Petioles stouter, evidently wing-margined.

1. *S. occidentalis*.

Sterile filament purple-brown, 1 mm. wide. Corolla 6-8 mm. long.
Calyx-lobes rounded-obtuse. Capsule ovoid, acute, 4-7 mm. long.
Seeds .5-.8 mm. long. Inflorescence pyramidal, 5-18 cm. wide,
its branches slender. Leaf-blades narrowed to cordate at base,
more finely crenate-serrate. Petioles slender, scarcely margined.

2. *S. marilandica*.1. *Scrophularia occidentalis* (Rydb.) Bicknell.

Scrophularia nodosa occidentalis Rydb., in Contrib. U. S. Nat. Herb. 3: 517.
1896. "Rapid City [South Dakota], altitude 1,000 m., July 25, [1892.
P. A. Rydberg] (No. 914)." Isotype seen in Herb. New York Botanical
Garden.

Scrophularia occidentalis (Rydb.) Bickn., in Bull. Torr. Bot. Club 23: 315.
1896.

Corolla externally greenish-brown and shining, within green or

distally brownish. Flowering in May or June.

Thickets and along streams, widely distributed through the Rocky Mountain plateau, eastward passing into *S. leporella* Bickn. In our area seen only as collected by Edward Palmer 218 at some point in Oklahoma, probably "on the False Washita, between Fort Cobb and Fort Arbuckle" in 1868.

OKLAHOMA.—: —, E. Palmer 218 (Y).

2. *Scrophularia marilandica* L.

Scrophularia marilandica L., Sp. Pl. 619. 1753. "Habitat in Virginia." Based upon a plant grown in the Upsala Garden, which from the description in the Hortus Upsalensis 177. 1748, would appear to have been the species here considered.

(?) *Scrophularia hastata* Raf., Fl. Ludov. 44. 1817. Based upon a fuller description in Robin, Voy. Louisiane 3: 395. 1807. Description of leaves 'soft to touch' appears to describe forma *neglecta* (below), but the leaves in this species can scarcely be called hastate. The carefully described flower however would appear to be of this genus, although no mention is made of the rudimentary fifth stamen, nor is the corolla ever pubescent within (veloutée).

Scrophularia neglecta Rydb.; Small, Fl. S. E. Un. St. 1058, 1337. 1903. "Type, Riley Co., Kans., Norton, no. 779 in Herb. N. Y. B. G." Type seen in Herb. New York Botanical Garden. This plant differs from what is considered true *S. marilandica* only in the presence of pubescence on the lower surface of the leaves, a condition found in the northern and predominating in the western part of the range of the species. Eastward this sporadic and fluctuating state can be only considered as a forma, *neglecta* (Rydb.) Pennell, comb. nov; the two should be studied.

Corolla externally greenish-brown, duller, within purple-brown distally. Flowering in September and October.

Open woodland, in central and northwestern Arkansas; and in southern Louisiana; certainly more generally distributed in our area. In our area only forma *neglecta* has been seen. A wide-spread eastern species, ranging from Massachusetts to Ontario and Nebraska, south to Georgia and Louisiana.

ARKANSAS. Benton: —, Plank (Y). Pulaski: Little Rock, Hasse (Y).

LOUISIANA. Iberia: Avery Id., Cocks (L, Y).

17. *COLLINSIA* Nuttall.

Collinsia Nutt., Journ. Acad. Nat. Sci. Phila. 1: 190. 1817.

Type species, *C. verna* Nutt., of Ohio.

1. *Collinsia violacea* Nutt.

Collinsia violacea Nutt., in Trans. Am. Phil. Soc. II. 5: 179. 1837. "Hab. On the hills and upland woods of the Arkansas and Red rivers; abundant. [T. Nuttall.] Type, labeled "Ark[ansas], Nuttall," seen in Herb. Academy of Natural Sciences of Philadelphia; isotype in Herb. of Columbia University at the New York Botanical Garden.

Sandy soil, hills of western Arkansas, and eastern Oklahoma and southward into short-leaf pineland of eastern Texas to Nacogdoches and Limestone counties, Texas. Also in extreme southwestern Missouri and southeastern Kansas. Flowering from March to early May, and soon ripening fruit.

ARKANSAS. Benton: —, Plank (Y). Sebastian: Hartford, Pilsbry (A). Washington: Fayetteville, Williamson (A).

OKLAHOMA. Atoka: Limestone Gap, Pilsbry (A). Craig: Vinita, Carleton 33 (U). Creek: Sapulpa, Bush 918 (Y).

TEXAS. Kaufman: Elmo, Reverchon 3935 (U). Limestone: —, Joor 49 (U). Nacogdoches: "Nagadoches," Leavenworth (A).

Readily distinguished from *C. verna* Nutt., of the Ohio Valley, by the following contrast:

Corolla blue, the nearly white posterior lobes little shorter than the shallowly notched antero-laterals. Seeds 3 mm. long. Leaves lanceolate-ovate, mostly obviously dilated proximally. Stem and pedicels with lines of pubescence. *C. verna*.

Corolla violet, the pale posterior lobes about two thirds the length of the deeply notched antero-laterals. Seeds 1 mm. long. Leaves oblong-lanceolate, not dilated at base. Stem and pedicels more densely finely pubescent over entire surface. *C. violacea*.

18. MAURANDYA Ortega.

Maurandya Ortega, Nov. Pl. Descr. Decad. 21. 1797.

Type species, *M. semperflorens* Ortega,³ of Mexico.

1. *Maurandya antirrhiniflora* Humb. & Bonpl.

Maurandya antirrhiniflora H. & B.; Willd., Hort. Berol. pl. 83. 1807. "Habitat in Mexico." Description distinctive.

Antirrhinum maurandioides A. Gray, in Proc. Am. Acad. 7: 376. 1868.

Based upon *Maurandya antirrhiniflora* G. & B.

Certainly closely akin to *M. scandens* (Cav.) Pers. [= *M. semperflorens* Ort.], being nearly alike in habit, leaves, pedicels, sepals, capsules and seeds, differing only in corolla. In *M. scandens* this is two-ridged within on anterior side, apparently in the manner of *Mimulus*, while the smaller corolla of *M. antirrhiniflora* has these ridges developed distally into a palate.

Corolla blue, the palate conspicuously raised, light-yellow. Flowering from April to September and soon ripening fruit.

Stony calcareous soil, river-bluffs and hills, lower Edwards Plateau and through arid southern Texas, from Travis and Gillespie to

³ Practically a re-description, with renaming, of *Usteria scandens* Cav., Icon. 15. 1793, antedated by *Usteria* Medik., 1790.

Nueces and Webb counties; lower Sonoran zone. Ranges from southern Texas and Arizona to southern Mexico.

TEXAS. Bexar: Comanche Spring; San Antonio, Pennell 5472 (P, Y). Gillespie: Threadgill, Jermy 487 (U). Hays: San Marcos, Pennell 10428 (A, Y). Nueces: Corpus Christi, Heller 1790 (A, U, Y). Travis: Austin, Pennell 10451 (Y); Barton Springs. Webb: Laredo, Letterman 35 (Y).

19. **LINARIA** Miller.

Linaria Mill., Gard. Dict. ed. IV. 1754.

Type species, *Antirrhinum linaria* L., of Europe.

Corolla, excluding spur, 4-12 mm. long, blue; posterior lip erect; anterior lip broadly spreading, but not forming a definite raised palate; spur slender. Capsule 2-3.5 mm. long, equaling to slightly exceeding the sepals. Seeds .3-.4 mm. long, cylindric, prismatic-angled, not winged. Stem less leafy, the younger stems spreading-prostrate from base.

(*Leptoplectron*.)

Surfaces of seeds smooth to slightly tuberculate, the angles thin.

Corolla less than 48 mm. long, excluding the spur which is 2-6 mm. long.

1. *L. canadensis*.

Surfaces and rounded angles of seed densely tuberculate. Corolla over 10 mm. long, excluding the spur which is 5-9 mm. long.

1a. *L. canadensis texana*.

Corolla, excluding spur, 15-18 mm. long, yellow; posterior lip arched over anterior; anterior lip forming a conspicuous protruding orange palate, spur stout. Capsule 10 mm. long, much exceeding the sepals. Seeds 1-7 mm. long, flattened and circularly broadly-winged. Stem densely leafy, always erect.

2. *L. linaria*.

1. **Linaria canadensis** (L.) Dum.-Cours.

Antirrhinum canadense L., Sp. Pl. 618. 1753. "Habitat in Virginia, Canada." Type probably from southern New Jersey, and certainly the species now considered. For discussion see Torrey 19: 151. 1919.

Linaria canadensis Dum.-Cours., Bot. Cult. 2: 96. 1802. "Lieu, Le Canada, la Virginie." Doubtless based upon *Antirrhinum canadense* L.

Corolla purplish-blue, the palate paler. Flowering from March to May, and soon ripening fruit.

Open sandy soil, usually a weed, eastward, chiefly in the Coastal Plain; less frequent than the following, with which it intergrades. Ranges through the Atlantic Coastal Plain, from Massachusetts to Florida and Texas; inland probably introduced.

ARKANSAS. Pope: Russellville, Pennell 10636 (Y).

LOUISIANA. Rapides: Alexandria, Hale (A, U, Y).

TEXAS. Angelina: —, Reverchon 3931 (Y). Dewitt: Cuero, Howell 318 (Y). Harris: Houston, Hall 406 (U). Kaufman: Terrell, Tyler (U). San Augustine: San Augustine, Crocket (U). Travis: Austin, York (T). Victoria: Victoria, Lewton 62 (U).

1a. *Linaria canadensis texana* (Scheele) Pennell, comb. nov.

Linaria texana Scheele, in *Linnaea* 21: 4761. 1848. "Zwischen Houston and Austin [Texas] häufig: "Römer." Description sufficiently distinctive.

Here distinguished primarily by roughness of seeds, which however varies from a few roughenings on the side to densely tuberculate. The wealth of Texan material at my disposal shows that each character of the contrasts previously outlined (in Contrib. U. S. Nat. Herb. 20: 323. 1920, and Proc. Acad. Nat. Sci. Phila. 71: 258. 1920) between this and *Linaria canadensis* breaks down in numerous instances through the area where the two overlap. Consequently it seems more rational to consider *texana* a variety, its range and relation to the species roughly paralleling that of *Veronica peregrina xalapensis* (H. B. K.) Pennell. For an excellent illustration of *Linaria canadensis texana* see the Botanical Magazine 63: pl. 3473. 1836.

Open sand or sandy loam, frequently or usually a weed, common through the Coastal Plain, chiefly westward; occasional and probably introduced inland. Ranges widely through western North America, and into South America.

ARKANSAS. Benton: —, Plank (Y). Columbia: Taylor, Hunt 10 (Y). Nevada: Prescott, Bush 555 (U).

OKLAHOMA. Kingfisher: Huntsville; Kingfisher, Stevens 189 (U). Oklahoma: Bethany, Pennell 10574 (H, O, U, Y). Payne: Stillwater, Learn (Y). Wagoner: Wagoner, Pennell 10614 (M, Y). Washita: Bessie, Stevens 961 (U). Woods: Alva, Stevens 3042 (U).

LOUISIANA. Acadia: Crowley, Pennell 10204 (Y). Catahoula: Sicily Id., Peck (A). Rapides: Alexandria, Ball 416 (U, Y). Terrebonne: E. C. Wurzlów (Y).

TEXAS. Austin: San Felipe, Pennell 10293 (K, T, Y); Wallis, Pennell 10270 (A, Y). Bastrop: Smithville, Pilsbry (A). Bexar: San Antonio: Larrabee (U). Duval: San Diego, Croft (U, Y). Fayette: Colony, Crawford (U). Gillespie: Dry Branch, Jermy 151 (U). Harris: Houston, Bush 51 (U). Henderson: Athens, Young (T). Kaufman: Terrell, Tyler (U). Nueces: Corpus Christi, Heller (Y). Robertson: Calvert, Merrill (Y). Tarrant:

Handley, Ruth 441 (Y). Travis: Austin, Bray 106 (Y). Victoria: Victoria, Williamson (A).

2. **Linaria linaria** (L.) Karst.

Linaria vulgaris Mill.

Loam or sandy fields, seen only from northern Arkansas. Naturalized from Eurasia.

20. **VERONICASTRUM** Heister.

Veronicastrum Heist.; Fabr., Enum. Meth. Pl. Hort. Helmstad. 111. 1759.

Type species, *Veronica virginica* L.

1. **Veronicastrum virginicum** (L.) Farwell.

Veronica virginica L., Sp. Pl. 9. 1753. "Habitat in Virginia." Grown in the Clifford Garden. Certainly the species here considered.

Leptandra villosa Raf., Med. Fl. 2: 21. 1830. "Mr. Schweinitz has found it in North Carolina." Name to be used for the forma *Veronicastrum virginicum* f. *villosum* (Raf.) Pennell, [in *Rhodora* 23: 6. 1921] prevalent in the South and West, which has its leaves downy pubescent beneath.

Veronicastrum virginicum (L.) Farwell, Drugg. Circ. 61: 231. 1917.

Corolla white or pinkish; anthers brown. Flowering in August.

Sandy or loam soil, meadows or thickets, in northern Louisiana and northeastern Texas; doubtless also in Arkansas. Ranges from Connecticut to Minnesota and Kansas, south to Mississippi and Texas.

LOUISIANA. Clairborne: ———, (L). Natchitoches: Natchitoches, Cocks (L).

TEXAS. Bowie: Texarkana, Heller 4198 (A, Y).

21. **VERONICA** Linné.

Veronica L., Sp. Pl. 9. 1753.

Type species, *Veronica officinalis* L., of Europe.

Main stem terminating in an inflorescence, the flowers remote and axillary. Leaves, except the lowermost, alternate, their blades oblanceolate to ovate. Annuals.

Pedicels shorter than the lanceolate to linear sepals. Capsule strongly flattened. Seeds many, less than 1 mm. long, smooth or nearly so. Plants erect.

Leaf-blades, excepting the lowermost, sessile, those of the lower stem-leaves oblanceolate, nearly entire to dentate. Corolla whitish throughout. Capsule greenish-brown, glabrous or minutely pubescent, less deeply notched, the minute style hidden between the capsule-lobes.

Plant glabrous. 1. *V. peregrina*.

Plant pubescent with short gland-tipped hairs, usually present even on the capsule. 1a. *V. peregrina xalapensis*.

Leaf-blades petioled or the upper nearly sessile, those of the lower stem-leaves ovate, crenate-serrate. Corolla deep violet-blue. Capsule yellowish-brown, pubescent with slightly gland-tipped hairs, notched nearly or about one third length, the longer style reaching about to the capsule-lobes. Plant pubescent with white glandless or obscurely gland-tipped hairs.

2. *V. arvensis*.

Pedicels longer than the ovate sepals. Capsule relatively turgid. Seeds few, 1.3–1.5 mm. long, roughened. Leaf-blades ovate, dentate. Corolla violet-blue.

Petals not exceeding the ovate sepals. Capsule 4 mm. wide, its lobes rounded in profile, the most distal point of each about midway between the style and the lateral margin. Style shorter than the capsule.

3. *V. polita*.

Petals much exceeding the narrowly ovate sepals. Capsule 5–6 mm. wide, its lobes acutish in profile, the most distal point of each near the lateral margin. Style as long as the capsule.

4. *V. persica*.

Main stem not terminating in an inflorescence, the flowers in axillary racemes. Leaves opposite throughout, their blades linear. Perennial.

5. *V. scutellata*.

1. *Veronica peregrina* L.

Veronica peregrina L., Sp. Pl. 14. 1753. "Habitat in Europae hortis, arvisque." Description distinctive of this American plant, which had become naturalized in Europe.

Corolla uniformly dull-white. Flowering from March to May, and soon ripening fruit.

Moist soil, river-banks, gardens and cultivated fields, common eastward but passing into and over most of our range represented by the following variety. Wide-spread through eastern North America.

ARKANSAS. Jefferson: Jefferson Springs, Pennell 10669a (Y). Pope: Russellville, Pennell 10635 (U, Y).

LOUISIANA. Acadia: Crowley, Pennell 10197 (L, Y). Jefferson: Gretna, Ball 322 (Y). Rapides: Alexandria, Hale (L).

1a. *Veronica peregrina xalapensis* (H. B. K.) Pennell.

Veronica xalapensis H. B. K., Nov. Gen. et Sp. 2: 389. 1818. "Crescit in Regno Mexicano prope Xalapa (alt. 630 hex.), in nemoribus *Liquidambaris styracifluae* [Humboldt & Bonpland]".

Veronica peregrina xalapensis (H. B. K.) Pennell, in Torrey 19: 167. 1919.

Varies in degree and length of pubescence, so evidently of only varietal status.

Sandy to clayey soil, ditches, stream-banks and fields, common through most of central and western Arkansas and Texas, eastward

passing into *V. peregrina* L. Wide-spread through western North and South America.

ARKANSAS. Franklin: Ozark, Pennell 10618 (Y).

OKLAHOMA. Oklahoma, Bethany, Pennell 10580 (O, Y).

TEXAS. Austin: Wallis, Pennell 10281 (U, Y). Bexar: —, Jermy (Y). Comal: New Braunfels, Lindheimer 1060 (T, Y). Harris: Houston, Pennell 10248 (Y), 10255 (T, Y). Hays: San Marcos, Stanfield (Y). Kerr: Kerrville, Pennell 10391 (A, H, Y). Tarrant: Fort Worth, Ruth 100 (Y). Travis: Austin, Pennell 10446 (Y).

2. *Veronica arvensis* L.

Corolla with all lobes deep sky-blue, whitish at base, veined with deeper sky-blue.

Fields and cultivated soil, especially where moist, seen from Arkansas and Oklahoma. Naturalized from Eurasia.

3. *Veronica polita* Fries.

Roadsides and gardens, seen from Louisiana and Texas. Naturalized from Eurasia.

4. *Veronica persica* Poir.

Corolla with posterior lobes sky-blue, anterior pale-blue, all whitish at base, and veined with deeper blue lines.

Fields and roadsides, seen from Texas. Naturalized from Eurasia.

5. *Veronica scutellata* L.

Waste ground, at Pineville, Rapides Parish, Louisiana, collected by R. S. Cocks. Surely adventive from the northern United States or Eurasia.

22. **DASISTOMA** Rafinesque.

Dasistoma Raf., Journ. de Phys. 88: 89. 1819.

Type species, *D. aurea* Raf., of Kentucky.

1. **Dasistoma macrophylla** (Nutt.) Raf.

Seymeria macrophylla Nutt., Gen. N. Am. Pl. 2: 49. 1818. "Hab. In shady alluvial soils of the banks of the Little Miami, near the town of Lebanon," Ohio, T. Nuttall. Specimen in Kew Herbarium labeled "Ohio, Nuttall misit Mart. 1824," may stand as the type; this seen.

Dasistoma macrophylla (Nutt.) Raf., New Fl. Am. 2: 67. 1837.

Brachygryne macrophylla (Nutt.) Small, Fl. S. E. Un. St. 1073, 1338. 1903.

Type of genus, *Brachygryne* Small.

Corolla yellow, externally tinged or marked with purple-red. Flowering in July and August and soon ripening fruit.

Sandy to clay soil, woodland, usually along streams, hills of northwestern Arkansas and eastern Oklahoma to Dallas County, Texas. Ranges from Ohio to eastern Nebraska, south to northern Alabama and northeastern Texas.

ARKANSAS. Benton: Sulphur Springs, Pennell 5362 (P). Washington: Fayetteville, Harvey 35 p. p. (A).

OKLAHOMA. Cleveland: Moore, McReynolds (O). Craig: Blue Jacket, Stevens 2212 (L). Creek: Sapulpa, Bush 446 (M). Payne: Stillwater, Waugh 33 (M, U). Rogers: Verdigris, Bush 415 (M).

TEXAS. Dallas: Dallas; Irving, Pennell 5398 (P, Y).

23. **AFZELIA** J. F. Gmelin.

Afzelia J. F. Gmel., Syst. 927. 1791.

Type species, *Anonymos cassioides* Walt.

Leaf-segments and calyx-lobes lanceolate or broader. Corolla externally pubescent, its lobes ovate. Capsule ovate or ovate-acuminate, glandular-tomentose. Seeds 1-1.5 mm. long, with reticulations raised and wing-like. Stem with spreading or reflexed hairs.

Filaments 1.5-2.5 mm. long, dilated and pubescent at least one half their length, the distal portion glabrous. Anther-cells, opening one half their length. Capsule ovate-acuminate with gland-tipped hairs. Reticulations of seed regular, raised less than the diameter of the seed. Stem glandular-pubescent with spreading hairs.

Capsule 9-12 mm. long. Seeds 1-1.2 mm. long. Pedicels 7-12 mm. long. Leaf-blades slightly bipinnatifid.

1. *A. havardii*.

Capsule 8-9 mm. long. Seeds 1.4-1.5 mm. long. Pedicels 3-5 (-9) mm. long. Leaf-blades strongly bipinnatifid.

2. *A. texana*.

Filaments 3 mm. long, dilated and pubescent about one fourth their length, the distal portion lanose with spreading hairs. Anther-cells opening one fourth or one fifth length. Capsule 5-7 mm. long, ovate, with mostly dark-jointed but not gland-tipped hairs. Reticulations of seed irregularly produced into three or four wings, which equal or exceed the diameter of the seed. Stem pubescent with fine reflexed or also longer spreading glandless hairs.

3. *A. pectinata*.

Leaf-segments and calyx-lobes filiform-linear. Corolla externally glabrous, its lobes lanceolate. Capsule 4-4.5 mm. long, urceolate-acuminate, glabrous. Seeds .5-.7 mm. long, with a scarcely reticular testa, furrowed. Stem sparingly pubescent with ascending incurved hairs.

4. *A. cassioides*.

1. *Afzelia havardii* Pennell, sp. nov.

Annual. Stem about 4 dm. tall, much branched, pubescent with retrorse-spreading to -incurved hairs, and with longer similar gland-tipped hairs. Leaf-blades lanceolate to ovate-lanceolate, slightly bipinnatifid, segments lanceolate, pinnae falcately spreading; glandular-hirsute on both surfaces; those of the stem 1.5-1.7 cm. long, 6-8 mm. wide, with 5-7 pairs of lateral lobes. Pedicels slender, in flower 6-10 mm. long, in fruit 7-12 mm. long. Calyx glandular-hirsute, its lobes 3-4 mm. long, lanceolate, acute, dentate. Corolla 7.5-8 mm. long; its lobes 5 mm. long, ovate; rounded, spreading, the two posterior united $\frac{1}{2}$ - $\frac{2}{3}$ their length; externally glandular-tomentose, within pubescent in a ring about the bases of the filaments, but glabrous below posterior sinus, the lobes irregularly ciliate. Filaments 2.5 mm. long, stout, posterior incurved, dilated and pubescent two-thirds length; anterior straight, less dilated, pubescent one-half length; connectives glabrous, anther-sacs 3 mm. long, linear-oblong, opening one-half length. Capsule 9-12 mm. long, narrowly ovate-acuminate, glandular-tomentose. Seeds 1-1.2 mm. long, pale-brown, the raised reticulations thin and somewhat wing-like; intrareticular lines very fine, continuous, forming a delicate parallel series.

Type, Eagle Pass, Texas, collected in flower and fruit in 1882, Dr. V. Havard; in Herb. Academy of Natural Sciences of Philadelphia.

Limestone hills (?), near the Rio Grande, Texas; arid Lower Sonoran zone.

TEXAS. Maverick: Eagle Pass, Havard (A, H). Also collected by Wright in 1848, but no station given.

2. *Afzelia texana* (A. Gray) Small.

Seymeria bipinnatisecta texana A. Gray, in Torrey, Bot. Mex. Bound. 117. 1859. "Upper Guadalupe river, etc.; Lindheimer" Several collections of Lindheimer seen, but none labeled "Upper Guadalupe river." Lindheimer 451 or 670 labeled "Pedernales," in Gray Herbarium, may stand as the type and has been seen there.

Afzelia texana (A. Gray) Small, Fl. S. E. Un. St. 1072, 1338. 1903.

Rocky limestone soil, Edwards Plateau of central Texas. Flowering in July and August, and soon ripening fruit.

TEXAS. Bexar: Comanche Spring, Lindheimer 1058 (A, C, H, K, M, P, U, Y). Gillespie: Fredericksburg; Pedernales; Threadgill, Jermy 452 (M, U). Hays: San Marcos, Stanfield (Y). Kerr: Kerrville, Pennell 10395 (T, Y).

3. *Afzelia pectinata* (Pursh) Kuntze.

Seymeria pectinata Pursh, Fl. Am. Sept. 2: 737. 1814. "In South Carolina. Catesby. v. s. in Herb. Sherard." Type not seen, but description distinctive.

Afzelia pectinata (Pursh) Kuntze, Rev. Gen. 1: 457. 1891.

Corolla deep golden-yellow, more or less marked with purple-red within throat and at the bases of the lobes. Flowering in August and September, and soon ripening fruit.

Dry sandy longleaf pineland, central Louisiana. Ranges from South Carolina and Florida to Louisiana.

LOUISIANA. Natchitoches: Natchitoches, Cocks (L).

4. *Afzelia cassioides* (Walt.) J. F. Gmel.

Anonymos cassioides Walt., Fl. Carol. 171. 1788. Presumably from lower South Carolina. Description sufficiently distinctive.

Afzelia cassioides (Walt.) J. F. Gmel., Syst. 927. 1791.

Gerardia afzelia Michx., Fl. Bor. Am. 2: 20. 1803. New name for *Afzelia cassioides* (Walt.) Gmel.

Seymeria tenuifolia Pursh, Fl. Am. Sept. 737. 1814. New name for *Gerardia cassioides* (Walt.) Pers.

Corolla pale-yellow, more or less marked with purple-red within throat and at the bases of the lobes. Flowering in September and October, and soon ripening fruit.

Sandy longleaf pineland, central Louisiana. Ranges from North Carolina and Florida to Louisiana.

LOUISIANA. Rapides: Alexandria, Cocks (L).

24. **AUREOLARIA** Rafinesque.

Aureolaria Raf., New Fl. Am. 2: 58. 1837.

Type species, *Aureolaria villosa* Raf.

Annual. Stem, leaves and calyx glandular-hirsute. Leaf-blades bipinnatifid, pectinately toothed. Calyx-tube glandular-hirsute, the lobes pectinately toothed. Corolla 30-40 mm. long, externally glandular-pubescent, with pubescent below posterior sinus and over bases of posterior lobes, more or less marked or tinged with purple-red. Capsule glandular-pubescent. Seeds .8-1 mm. long, not winged. (*Panctenis* Raf.)

1. *A. pectinata*.

Perennials. Not glandular. Leaf blades entire to somewhat bipinnatifid, not pectinately cut. Calyx-tube not glandular, the lobes entire to dentate. Corolla externally glabrous, within glabrous or diffused-pubescent, uniformly yellow. Capsule not glandular. Seeds 1.5-2.7 mm. long, strongly winged. (*Aureolaria*, sensu strictu.)

Capsule densely rusty-pubescent. Pedicels 1.5-3 mm. long.

Stem puberulent to pubescent. 2. *A. virginica*.

Capsule glabrous. Pedicels 3-15 mm. long.

Plants densely cinereous-puberulent. Wings but one sixth to one fifth the diameter of the seeds. Corolla 40-50 mm. long.

Calyx-lobes broadly lanceolate, evidently dentate. Bracts

coarsely toothed. Petioles apparently mostly only 5-6 mm. long.

3. *A. grandiflora*.

Calyx-lobes linear to lanceolate, entire to slightly dentate. Bracts entire to serrate. Petioles mostly 10-15 mm. long.

Upper leaf-blades gradually smaller than the lower, relatively large. Pedicels stout. More densely cinereous.

3a. *A. grandiflora cinerea*.

Upper leaf-blades rather abruptly smaller than the lower, relatively small. Pedicels slender. Less densely cinereous.

3b. *A. grandiflora serrata*.

Plants glabrous to minutely puberulent. Wings one fourth to two fifths the diameter of the seed. Calyx-lobes entire.

Stem finely puberulent, not glaucous. Pedicels and calyx externally puberulent. Corolla 40-50 mm. long.

4. *A. dispersa*.

Stem glabrous, glaucous. Pedicels and calyx externally glabrous.

Leaf-blades, at least the lower, somewhat pinnately cut, the segments lanceolate or broader. Corolla 40-60 mm. long, somewhat pubescent within above bases of filaments. Awn of anther 1-1.5 mm. long. Capsule 15-29 mm. long. Plant relatively stout.

5. *A. flava macrantha*.

Leaf-blades all very deeply pinnately cut, the segments linear-lanceolate or nearly linear. Corolla 40-45 mm. long, glabrous within above bases of filaments. Awn of anther 1.5-2 mm. long. Capsule 12-15 mm. long. Plant relatively slender.

6. *A. calycosa*.

1. ***Aureolaria pectinata*** (Nutt.) Pennell.

Gerardia pedicularia pectinata Nutt., Gen. N. Am. Pl. 2: 46. 1818. "Hab. In the sandy pine forests of Carolina and Georgia." Probable type, collected by Nuttall and now in the British Museum, has been verified by Dr. S. Moore as the plant here considered.

Aureolaria pectinata (Nutt.) Pennell, in Bull. Torr. Bot Club. 40: 314. 1913.

Corolla yellow, externally more or less tinged with reddish, within not marked with purple-red. Flowering from July to October, and soon ripening fruit.

Dry sandy pine and oak lands, especially hilly, in the Coastal Plain of Louisiana, and doubtless also in eastern Arkansas; on the lower Ouachita Hills in Arkansas. Ranges through the Coastal Plain from South Carolina to Florida and Louisiana.

ARKANSAS. Garland: Hot Springs, Pennell 5680 (A, C, H, K, M, P, U, Y). Pulaski: Little Rock, Engelmann 313 (M).

LOUISIANA. Caddo: Shreveport, Cocks (L). Rapides: Alexandria; Pineville, Pennell 5638 (C, H, L, M, P, U, Y).

2. *Aureolaria virginica* (L.) Pennell.

Rhinanthus virginicus L., Sp. Pl. 603. 1753. "Habitat in Virginia." Type, Clayton 488, is identified by Dr. S. F. Blake in *Rhodora* 20: 66, 1918, as the species here considered.

Aureolaria villosa Raf., New Fl. Am. 2: 59. 1837. No type locality stated, nor type known to exist. Description sufficiently distinctive.

Aureolaria virginica (L.) Pennell, in Bull. Torr. Bot. Club. 40: 409. 1913.

Corolla yellow, with no tinge of purple-red. Flowering in June or July.

Open sandy woodland, among oaks, in central Louisiana. Ranges from New Hampshire to Michigan, south to Florida and Louisiana. Unknown elsewhere west of the Mississippi River.

LOUISIANA. Rapides: Alexandria, Hale (L).

3. *Aureolaria grandiflora* (Benth.) Pennell.

Gerardia grandiflora Benth., in Comp. Bot. Mag. 1: 206. 1826. "Province of Texas, Drummond." Type, Drummond 293, seen in Kew Herbarium.

Dasystoma drummondii Benth., in DC. Prod. 10: 520. 1846. "In Texas (Drummond!) *Gerardia grandiflora* Benth! . . . (v. s.)" Type, identical with preceding, Drummond 293, seen in Kew Herbarium.

Aureolaria grandiflora (Benth.) Pennell in *Rhodora* 20: 135. 1918.

Probably in sandy oak woods, Coastal Plain of southeastern Texas. Including varieties, the species ranges northward to Wisconsin. Flowering in June and July.

TEXAS. Austin: San Felipe, Drummond 293 (H, K). Harris: Houston, Hall 420 (H, K, M, U, Y). Waller: Hempstead, Hall 419 (H, M, U, Y)

3a. *Aureolaria grandiflora cinerea* Pennell, var. nov.

Stem 10-12 dm. tall, more densely cinereous-puberulent. Petioles about 10-15 mm. long. Lower leaves lanceolate to ovate lanceolate usually more deeply incised, though only at times in broad basal portion of lowest leaves reaching nearly to the midrib, (5-) 9-15 cm. long, with 2-6 pairs of lateral lobes, rarely nearly entire, upper leaves smaller, though larger than in the species, and less cut; bracts nearly entire, or more frequently serrate, or even lacinate toward the base; leaves more cinerous. Pedicels stouter. Calyxlobes 8-12 mm. long, linear-lanceolate to lanceolate, entire or slightly dentate. Capsule 13-17 mm. long. Otherwise as in the species.

Type: Neck, Jasper Co., Missouri, collected in fruit, F. W. Pennell 5374; in Herb. University of Pennsylvania.

Corolla yellow, with no tinge of purple-red. Flowering in July and August, fruiting September and October.

Dry oak-woods, red loam or on usually more or less sandy soil, from the valley of the Missouri River in central Missouri to the upper Trinity River in Texas.

ARKANSAS. Washington: Fayetteville, Harvey 59 (M).

OKLAHOMA. Cleveland: P. J. White 191 (M). Haskell: San Bois Mts., Sheldon 325 (U). LeFlore: Page, Stevens 2709 (I).

Texas. Dallas: Dallas, Reverchon 711 (M, U). Smith: Swan, Reverchon 3228 (M).

3b. *Aureolaria grandiflora serrata* (Torr.) Pennell, comb. nov.

Dasystoma drummondii serrata (Torr.) Benth., in DC. Prod. 10: 521. 1846.

"In Louisiana ad Red River (Hale!) *Gerardia serrata* Torrey! . . . (V. in herb. Torrey)." Type in Kew Herbarium verified by N. E. Brown as agreeing with my number 5675. Isotype seen in Herbarium Columbia University.

Gerardia grandiflora integrifolia A. Gray, Syn. Fl. N. Am. 2. 1: 291. 1878. *G. serrata*, Torr., Benth. . . . W. Louisiana, Hale." Type same as preceding.

Corolla yellow, with no tinge of purple-red. Flowering in July and August.

Sandy oak-woods, short-leaf pine region of northwestern Louisiana and northeastern Texas, probably also in the long-leaf pinehills north of Alexandria, Louisiana.

LOUISIANA. Caddo: Shreveport, Pennell 5662 (A, C, H, I, L, M, P, U, Y). Natchitoches: Chopin, E. J. Palmer 8847 (M). Rapides Alexandria, Hale (L, Y).

TEXAS. Bowie: Texarkana, Pennell 5675 (A, C, H, K, M, P, S, T, U, Y). Rusk or Panola: between Tatum & Beckville. Reverchon 3227 (H, M, U).

4. *Aureolaria dispersa* (Small) Pennell.

Dasystoma dispersa Small, in Bull. Torr. Bot. Club. 28: 452. 1901. "Louisiana, Feliciana, Carpenter; type in the Herb. of Columbia University." Type seen.

Aureolaria dispersa (Small) Pennell, in Bull. Torr. Bot. Club. 40: 411. 1913.

Corolla yellow, with no tinge of purple-red. Flowering in August and September.

Sandy thickets and oakland, in the long-leaf pine belt of southern Louisiana. Ranges eastward to southern Alabama.

LOUISIANA. Acadia: Crowley, Pennell 10188 (Y). Rapides: Pineville, Pennell 5639 (C, H, L, M, P, U, Y).

5. *Aureolaria flava macrantha* Pennell, var. nov.

Leaves tardily glabrate or permanently pubescent above. Calyx-lobes 5-14 mm. long. Corolla (35-) 40-60 mm. long. Capsule 15-20 mm. long. Otherwise as in the species, *Aureolaria flava* (L.) Farwell.

Corolla yellow, with no tinge of purple-red. Flowering from July to September, fruiting August to October.

Oakwoods, frequently sandy or rocky, in the Ouachita Hills of central Arkansas. Ranges from southern Ontario to Alabama, Illinois and Arkansas, eastward passing into the species.

ARKANSAS. Garland: Hot Springs, Pennell 5682 (C, H, K, M, P, U, Y). Pulaski: Little Maumelle, Engelmann 407 (M). Saline —, Harvey 35 (H).

6. *Aureolaria calycosa* (Mack. & Bush) Pennell, comb. nov.

Dasystoma calycosa Mack. & Bush, in Rep. Missouri Bot. Gard. 16: 105. 1905. "Monteer, Shannon Co., Mo. Bush 219, July 31, 1899, type." Type seen.

Corolla yellow, with no tinge of purple-red. Flowering in July and August.

Stony oak-land, common in the Ozark Mountains of southern Missouri and northern Arkansas, also occurs in red loam region of northwestern, and granitic region of central Arkansas, also in sandy pineland of the Coastal Plain of eastern Arkansas.

ARKANSAS. Baxter: Cotter, E. J. Palmer 8414 (M.) Franklin: Ozark, Pennell 10620 (Y). Izard: Penters Bluff, Pennell 10676 (Y). Jefferson: Jefferson Springs, Pennell 10664 (Y). Pulaski: Little Maumelle; Little Rock, Pennell 5679 (C, H, M, P, U, Y), 10645 (Y). Saline —, Harvey 35 (H). White: Bald Knob, Biltm. Herb. 2827 (U).

25. *AGALINIS* Rafinesque.

Agalinis Raf., New Fl. Amer. 2: 61. 1837.

Type species, *A. palustris* Raf., of the Atlantic seaboard.

Capsule oblong to ovoid-oblong. Calyx-lobes 3–8 mm. long, Corolla pubescent within in a narrow line below posterior sinus.

Leaves lanceolate to lance-acuminate, entire or some trifid at base, slightly scabrous above, 2–6 mm. wide. Pedicels 2–3 mm. long. Calyx-lobes as long as or longer than the tube. Corolla 25–30 mm. long, its lobes widely spreading. Anther-cells caudate or awned at distal apex, densely lanose-pubescent. Stem glabrous, and branches spreading. I. HETEROPHYLLAE.

1. *A. heterophylla*.

Leaves narrowly linear, entire, very scabrous above, .8–1.5 mm. wide. Pedicels 5–16 mm. long. Calyx-lobes about one half the length of the tube. Corolla 20–26 mm. long, its posterior lobes ascending-spreading. Anther-cells obtuse to acutish at distal apex, moderately lanose-pubescent. Stem scabrel-lous, and branches ascending.

II. ASPERAE.

2. *A. aspera*.

Capsule globose to globose-obovoid. Calyx-lobes less than the length of the tube.

Corolla with lobes all spreading, pubescent within at base of posterior lobes.

Seeds dark-brown. Plants tending to blacken in drying.

Calyx-tube not decidedly reticulate-venose.

III. PURPUREAE.

Inflorescence of elongated normal racemes; the pedicels less than 12 mm. long. Corolla pubescent within over nearly entire width of basal portions of posterior lobes.

Leaves and calyx-lobes obtuse to acutish. Anther-cells obtuse to acutish at distal apex. Plant fleshy, bushy-branched below and with elongated racemes above.

Pedicels 5–12 mm. long. 3. *A. spici flora*.

Leaves and calyx-lobes acute to acuminate. Anther-cells mucronate to caudate at distal apex. Plants not fleshy, more uniformly branched. Pedicels .5–5 (–8) mm. long.

Stem smooth or minutely scabrellous. Axillary fascicles not or scarcely developed, if present shorter than the leaves. Seeds .6–1.5 mm. long.

Axillary fascicles slightly developed. Pedicels 3–8 mm. long. Corolla 20–38 mm. long. Seeds .9–1.5 mm. long; areas between reticulations mostly paler and intrareticular lines discernible.

4. *A. purpurea*.

Axillary fascicles scarcely or not developed. Pedicels 2–3 mm. long. Corolla 20–25 mm. long. Seeds .9–1 mm. long; areas between reticulations nearly black and no intrareticular lines discernible.

5. *A. pinetorum*.

Stem more or less scabrous. Axillary fascicles abundantly developed, mostly equaling the leaves. Seeds .5–.8 mm. long. 6. *A. fasciculata*.

Inflorescence usually of shorter racemes (if elongated, pedicels over 10 mm. long), usually some flowers, by slower or arrested growth of stem-apex appearing nearly terminal; pedicels 5–40 mm. long.

Corolla 20–40 mm. long, pubescent within in narrow line below sinus of posterior lobes. Seeds with intrareticular areas broad, nearly hexagonal. Stigma 3–4 mm. long. Chief cauline leaves 2–3.5 cm. long, those of the branches not scale-like.

Stem scabrous. Axillary fascicles abundantly developed. Calyx-lobes minute, .1–.6 mm. long. Pedicels 25–40 mm. long. 7. *A. pulchella*.

Stem glabrous or nearly so. Axillary fascicles scarcely

or not developed. Calyx-lobes longer, triangular-lanceolate or -subulate. Pedicels 15-30 mm. long. Corolla 25-30 mm. long, slightly upcurved, its lobes strongly ciliate. Anther-cells obtuse to acutish at distal apex. Calyx-lobes .7-1 mm. long. Leaves filiform, .3-.8 mm. wide.

8. *A. caddoensis*.

Corolla 20-25 mm. long, strongly upcurved, its lobes slightly ciliate. Anther-cells acuminate-attenuate at distal apex. Calyx-lobes 1-2 mm. long. Leaves linear, 1-3 mm. wide.

9. *A. strictifolia*.

Corolla 15-22 mm. long, pubescent within over entire width of basal portions of posterior lobes. Seeds with intrareticular areas elongated, narrow. Stigma 2 mm. long. Chief cauline leaves .5-1 cm. long, those of the branches scale-like.

10. *A. oligophylla*.

Seeds yellowish-brown. Plants not tending to blacken in drying. Calyx-tube evidently reticulate-venose. Racemes little elongated, and some flowers appearing terminal.

IV. ERECTAE.

Corolla 12-18 mm. long pink, with prominent red spots within. Stigma 2-3 mm. long. Capsule globose to globose-ovoid, brown, 4-5 mm. long. Seeds rounded and turgid. Calyx-lobes .5-1.8 mm. long. Pedicels 8-30 mm. long. Plant divaricately and relatively evenly branched.

11. *A. gattingeri*.

Corolla 8-12 mm. long, pale-pink, with faint spots within. Stigma 1 mm. long. Capsule globose-obovoid, light-brown, 5-6 mm. long. Seeds angled, not turgid. Calyx-lobes 1.5-2 mm. long. Pedicels 5-22 mm. long. Plant widely branched, the primary branches long and laxly ascending.

12. *A. viridis*.

Corolla with posterior lobes arched or flattened over stamens and style, the anterior lobes spreading.

V. TENUIFOLIAE.

Posterior corolla-lobes over one half length of anterior, concave-arched. Stem nearly or quite glabrous. Axillary fascicles not or but moderately developed.

Corolla 20-23 mm. long, pubescent within in narrow line below posterior sinus. Seeds nearly black, with reticulations firm and enclosing nearly hexagonal sunken areas; intrareticular lines none. Leaves scabro-roughened to nearly glabrous above.

Calyx-lobes .1-4 mm. long, triangular-subulate to subulate.

13. *A. edwardsiana*.

Calyx-lobes .6-1 mm. long, triangular to triangular-acuminate.

13a. *A. edwardsiana glabra*.

Corolla 10-23 mm. long, glabrous within below posterior

sinus. Seeds brown, with reticulations firmer and enclosing broad, angular, not sunken spaces; intrareti-
ular lines fine. Leaves somewhat scabrous above.

Corolla 15–23 mm. long. Calyx-lobes .2–1 mm. long.

14a. *A. tenuifolia leucanthera*.

Corolla 10–15 mm. long. Calyx-lobes (.5–)1–2 mm. long.

Branches spreading. Leaves slightly scabrous above,
spreading. Axillary fascicles slightly or not develop-
ed. Filaments lanate. Anther-cells densely lanose.

14b. *A. tenuifolia macrophylla*.

Branches ascending. Leaves slightly to decidedly
scabrous above, ascending. Axillary fascicles relative-
ly conspicuously developed. Filaments somewhat lan-
ate to glabrous. Anther-cells sparingly to moderately
lanose.

14c. *A. tenuifolia parviflora*.

Posterior corolla-lobes less than one half length of anterior,
flattened-ascending, the corolla 23–27 mm. long, pubes-
cent within a narrow line below posterior sinus. Stem
scabrous. Axillary fascicles conspicuously developed.

15. *A. homalantha*.

1. *Agalinis heterophylla* (Nutt.) Small.

Gerardia heterophylla Nutt., in Trans. Am. Phil. Soc. II. 5: 180. 1834.

"Hab. In the prairies of the Arkansas, near Great Salt River," Oklahoma.

Type probably a specimen seen in Herb. Columbia University, labeled
"Arkansas, Nuttall, *Gerardia trifida*."

Gerardia crustata Greene, Leaflets Bot. Obs. & Crit. 2: 108. 1910. "Sap-
ulpa, Indian Territory, 21 Sept. 1894, collected by B. F. Bush. Type
specimens in my herbarium." Type, Bush 417, seen in Herb. Greene, now
at the University of Notre Dame. It is the prevalent form with leaves
all entire.

Agalinis heterophylla (Nutt.) Small; Britton & Brown, Ill. Fl. N. Un. St. &
Can. ed. II. 3: 209. 1913.

Corolla pale-pink, with two yellow lines and many diffused small
purple-red spots within throat anteriorly. Flowering from late
August to early October.

Sandy or sandy loam, or rarely black calcareous soil, prairie or
occasionally pineland, southeastern Missouri and northeastern
Oklahoma to southwestern Louisiana and southeastern Texas.
Chiefly on the Coastal Plain; most frequent in the coastal prairie
and on the edge of the salt-marshes, less frequent to occasional
through the short-leaf pine belt and on alluvial soils to southeastern
Missouri, and occasional in the black calcareous prairie of central
Texas; inland locally frequent in the sandy prairies of eastern
Oklahoma.

ARKANSAS. Lincoln: Varner, Bush 132 (M, U, Y). Pulaski:
Little Rock, Hasse (Y).

OKLAHOMA. Cleveland: Norman, Emig 338 (U). Craig: Vinita, Bush 416 (M). Creek: Sapulpa, Bush 417 (H, M, U, Y). Sequoyah: Blunt, E. Palmer (U).

LOUISIANA. Caddo: Shreveport, Pennell 5663 (L, M, P, Y). Calcasieu: Lake Charles, Pennell 5618 (P, U). Cameron: Cameron, Cocks 3110 (H).

TEXAS. Austin: Industry, H. Wurzelow (I). Brazoria: Brazoria; Columbia, Bush 290 (M). Colorado: Alleyton, Pennell 5559 (A, C, H, P, U, Y); Columbus; Eagle Lake, Pennell 5547 (A, C, H, L, M, P, U, Y). Dallas: Dallas, Reverchon 712 p. p. (H, M, U). Galveston: Galveston Id., Pennell 5571 (A, C, H, J, K, L, M, P, U, Y). Harris: Brookline, Pennell 5566 (P, U); Harrisburg, Pennell 5578 (A, C, H, P); Webster, Pennell 5569 (H, M, P, U). Matagorda; Van Vleck, Pennell 5506 (I, P, U). Navarro: Corsicana, Reverchon 3224 p. p. (M). Orange: Orange, Pennell 5611 (A, C, H, I, J, M, P, U, Y). Robertson: Hearne, Pennell 5420 (A, C, M, P, U, Y). Tarrant: Fort Worth, Ruth 72 (C); Handley. Travis: Austin, Young (T). Upshur: Big Sandy, Reverchon 3223 p. p. (M). Victoria: Victoria, Pennell 5502 (A, C, H, J, K, L, M, P, S, T, U, Y).

2. *Agalinis aspera* (Dougl.) Britton.

Gerardia aspera Dougl.; Benth., in DC. Prod. 10: 517. 1846. "In America boreali centrali, in planitie Red River (Douglas!) " Type, collected by Douglas in Manitoba in 1827, not verified, but certainly the species here considered.

Agalinis aspera (Dougl.) Britton; Britton & Brown, Ill. Fl. N. Un. St. & Can. ed II. 3: 209. 1913.

Corolla pale-pink, with two yellow lines and many diffused small purple-red spots within throat anteriorly. Flowering in August.

Prairies of central Oklahoma, south to Kiowa County. Through the great Plains north to South Dakota, Manitoba and Illinois.

OKLAHOMA. Alfalfa: Carwile, Ward 45 (U, Y). Kay: Tonkawa, Barker (C). Kiowa: Snyder, Eggert (M). Payne: Stillwater, Waugh 215 (M, U).

3. *Agalinis spiciflora* (Engelm.) Pennell.

Gerardia maritima grandiflora Benth., in Compan. Bot. Mag. 1: 208. 1836. "Texas, Drummond, 1st. coll." Type, in Kew Herbarium, verified by Dr. N. E. Brown as agreeing with my number 4702 from Florida; isotype seen in Herb. of Columbia University.

Gerardia spiciflora Engelm., in Boston Jour. Nat. Hist. 5: 227. 1845. New name for *Gerardia maritima grandiflora* Benth.

Agalinis spiciflora (Engelm.) Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 277. 1920.

Corolla pink, with two yellow lines and many small purple-red spots within throat anteriorly. Flowering from March to September.

Salt marshes, along the Gulf Coast west to Galveston Island, Texas. Along the Atlantic and Gulf coasts from North Carolina to Texas, and on the Bahaman, Cuban, and Yucatan coasts.

LOUISIANA. Jefferson: Grand Isle, Langlois (N). Terre Bonne: Timbalier Id., E. C. Wurzlöw (Y).

TEXAS. Galveston: Galveston Id., Lindheimer 141 (H, M).

4. *Agalinis purpurea* (L.) Pennell.

Gerardia purpurea L., Sp. Pl. 610. 1753. "Habitat in Virginia, Canada."

Linnean diagnosis includes both long- and short-pedicel plants so could include all pink ("purple") flowered species. The first citation accompanied by a figure, Plukenet's *Digitalis virginiana rubra, foliis & facie Antirrhini vulgaris*, evidently the prevalent plant of the Atlantic seaboard, is considered as the type.

Agalinis purpurea (L.) Pennell, in Bull. Torr. Bot. Club 40: 126. 1913.

Corolla rose-pink, with two yellow lines and many diffused small purple-red spots within throat anteriorly. Flowering from July to September.

Moist sandy soil, mostly along rivers, in short-leaf pine belt of the Coastal Plain of Arkansas, Louisiana and eastern Texas, and probably in heavier soils entering the long-leaf pineland (where in lighter soils it is replaced by *A. pinetorum* Pennell). Ranges from Massachusetts to Minnesota, south to Florida and Texas.

ARKANSAS. Jefferson: Pine Bluff, Pennell 5683 (A, C, H, L, M, P, U, Y). Pulaski: Little Rock, Hasse (Y).

LOUISIANA. Boissier: Alden Bridge, Trelease (M). Ouachita: Sicard, E. J. Palmer 8927 (M). Rapides: Alexandria, Cocks (L).

TEXAS. Harris: Houston, Hall 418 p. p. (I). Smith: Tyler, Reverchon (M). Van Zandt: Grand Saline, Reverchon 2112 p. p. (M, U, Y).

5. *Agalinis pinetorum* Pennell.

Agalinis pinetorum Pennell, in Bull. Torr. Bot. Club 40: 424. 1913. "Type, St. Marks, Wakulla Co., Florida, Sept. 26, 1912, F. W. Pennell 4708, in Herb. University of Pennsylvania."

Corolla pink, with two yellow lines and diffused purple-red spots within throat anteriorly. Flowering in late September and October.

Moist soil, in long-leaf pineland and on coastal prairie, central and southern Louisiana. Ranges eastward in long-leaf pine belt to southern Georgia and northern Florida.

LOUISIANA. Calcasieu: Lake Charles, Pennell 5621 (A, C, H, J,

M, P, T, U, Y). Rapides: Pineville, Pennell 5643 (C, P), 5648 (A, H, K, L, M, P, U, Y).

6. *Agalinis fasciculata* (ELL.) Raf.

Gerardia fasciculata Ell., Sketch Bot. S. C. and Ga. 2: 115. 1822. "Grows principally in lands subject to occasional inundation from the ocean — on Edings Island near Beaufort very common." South Carolina. Type seen at the Charleston Museum.

Agalinis fasciculata (Ell.) Raf., New Fl. Am. 2: 63. 1837.

Gerardia galvesiana Greene, Pittonia 5: 138. 1903. "Galveston Id. [Texas], S. M. Tracy, 24 Sept. 1901." Type seen in Greene Herbarium now at University of Notre Dame. A rank, probably salt-marsh plant.

Gerardia langloisii Greene, Leaflets Bot. Obs. and Crit. 2: 108. 1910. "Known only as collected by the late Father Langlois in prairies near Eunice, Louisiana, 12 Sept., 1894." Type seen in Greene Herbarium. A small-flowered form.

Gerardia asprella Greene, l. c. 109. 1910. "Near St. Martinsville, Louisiana, 27 Sept., 1892, A. B. Langlois." Type seen in Greene Herbarium. A small-flowered form.

Corolla pink, with two yellow lines and many diffused purple-red spots within throat anteriorly. Flowering from August to October.

Sandy or clayey loam, especially in old fields, also in prairies and pineland; short-leaf pineland of southern Arkansas and eastern Texas; in the long-leaf pineland and coastal prairie of Louisiana and southeastern Texas (where frequently of more condensed habit and with smaller flowers = *Gerardia langloisii* and *asprella*), also west of the Ozarks in central Oklahoma and southwestern Missouri. Ranges eastward through the Coastal Plain to South Carolina.

ARKANSAS. Hempstead: Washington, Pennell 5677 (P, Y). Miller: Texarkana, Letterman (Y). Nevada: Prescott, Hollister 99 (U).

OKLAHOMA. Creek: Sapulpa, Bush 418 (H, M, U, Y), Pennell 5396 (M, P, U).

LOUISIANA. Calcasieu: Kinder, Pennell 5636 (A, H, M, P, U, Y). Rapides: Pineville, Pennell 5644 (P), 5645 (C, P, U, Y).

TEXAS. Bowie: Texarkana, Heller 4271 (A, C, H, M, U, Y). Galveston: Galveston Id., Tracy 7603 p. p. (H, N, Y). Harris: Brookline, Pennell 5565 (P); Harrisburg, Pennell 5563 (P), 5579 (P, Y); Houston, Hall 418 p. p. (H, I, M, U, Y); Sheldon; Webster, Pennell 5570 (J, K, N, P, U). Jasper: Buna, Pennell 5588 (P, U), 5604 (P). Matagorda: Van Vleck, Pennell 5511 (C, P, T). Montgomery: Conroe, Pennell 5580 (A, I, N, P), 5582 (H, M, P, Y). Navarro: Corsicana, Reverchon 3224 p. p. (M).

Orange: Orange, Pennell 5609 (P), 5610 (A, H, P, U). Panola: Beckville, Reverchon 2747(M). Polk: Livingston, E. J. Palmer 6751 (M). Robertson: Hearne, Pennell 5423 (A, C, H, M, P, U). Rusk: —, Vinzent (M). Upshur: Big Sandy, Reverchon 3223 p. p. (M).

7. *Agalinis pulchella* Pennell.

Agalinis pulchella Pennell, in Bull. Torr. Bot. Club 40: 428, 1913. "Type, Ponce de Leon, Holmes Co., Florida, Sept. 17, 1912, F. W. Pennell 4658, in Herb. University of Pennsylvania."

Corolla rose-pink, with two yellow lines and relatively large purple-red spots within throat anteriorly. Flowering in September.

Open sandy long-leaf pineland, central Louisiana. Ranges eastward to southern Georgia and northern Florida.

LOUISIANA. Rapides: Glenmora, Pennell 5631 (L, M, P, U); Pineville, Pennell 5637 (A, C, H, P, U, Y).

8. *Agalinis caddoensis* Pennell, sp. nov.

Annual. Plant dull-green or purplish, tending to blacken in drying. Stem 4–6 dm. tall, slender, with many loosely ascending branches, finely striate, 4-angled above, very sparingly scabrelous. Leaves opposite, or sparingly subopposite above, spreading, filiform, entire, acuminate, strongly involute, those of the stem 2.5–3 cm. long, .8 mm. wide; bracts slightly reduced; leaves scabrous above. Axillary fascicles not developed. Racemes scarcely elongated, broken, frequently but one flower of pair developed, 1–5 flowered. Pedicels ascending-spreading, slender, sparingly scabrelous to glabrous, in flower 13–22 mm. long, equaling to slightly longer than the bracts, many on the branches appearing as terminal. Calyx-tube 4–5 mm. long, hemispheric-campanulate, obscurely 5-ribbed, truncate; its lobes .7–1 mm. long, triangular-subulate, not callose; apex of tube and lobes within evidently puberulent. Corolla (20–) 25–30 mm. long, spreading 23–28 mm. wide, membranous, its tube 19–23 mm. long, slightly upcurved, its lobes 6–7 mm. long, rounded to retuse, all spreading; externally minutely pubescent in line below posterior sinus; lobes ciliate, the posterior slightly more so; rose-pink, 2 yellow lines and many small diffused red-purple spots within throat anteriorly. Filaments flattened, posterior 7–9 mm. long, anterior 11–13 mm. long, all lanose, especially toward apex; anther-cells 3–3.5 mm. long, oblong-lanceolate, obtuse to acutish at base, lanose with white hairs on the valvular surface, glabrous on the sides. Style 11–13 mm. long, linear, pubescent. Stigma 3.5 mm. long. Capsule not seen.

Type, dry loam oakwoods along Kansas City Southern Railroad 2–3 miles northwest of Shreveport, Caddo Parish, Louisiana;

collected in flower October 5, 1913, F. W. Pennell 5653; in Herb. University of Pennsylvania; flowers in October.

Dry loam oakwoods around Shreveport, Caddo Parish, Louisiana.

LOUISIANA. Caddo: Shreveport, Pennell 5655 (A, J, L, P, U), 5658 (C, H, K, M, P, U, Y), 5665 (P).

9. *Agalinis strictifolia* (Benth.) Pennell, comb. nov.

Gerardia strictifolia Benth., in Comp. Bot. Mag. 1: 209. 1836. "Hab. Texas, Drummond, (3rd Coll. n. 294)." Type seen in Kew Herbarium. Iso-type in Herb. Academy of Natural Sciences of Philadelphia, etc.

Corolla pale purplish-pink, with two yellow lines and many diffused purple-red spots within throat anteriorly. Flowering from late August to early October.

Sandy soil, or more rarely black calcareous loam, Coastal Plain, from Austin and Travis to Webb counties, southern Texas. Frequent or common through the sandy southern Fayette prairie region and on the coastal prairie, less frequent inland in the black belt; in the valley of the Nueces River and on the lower Rio Grande.

TEXAS. Austin: San Felipe, Drummond 294 (A, H, K, Y). Lavaca: Hallettsville, Fisher 125 (U). Nueces: Corpus Christi, Rose 18066 (U). Travis: Austin, Pennell 5431 (A, H, J, M, P, U, Y). Victoria: Aloe, Pennell 5492 (C, L, N, P, U, Y); Victoria, Pennell 5489 (I, P, S). Webb: Rio San Pedro, etc., Schott (H).

10. *Agalinis oligophylla* Pennell.

Gerardia aphylla grandiflora Benth., in Compan. Bot. Mag. 1: 174. 1836. "Jacksonville [Drummond]." Type labeled "Jacksonville," evidently the present Jackson, Louisiana, seen in Kew Herbarium.

Gerardia plukenetii microphylla A. Gray, Syn. Fl. N. Am. 1. II: 293. 1878. "Louisiana, Drummond, Hale." Type, an isotype of *Gerardia aphylla grandiflora* Benth., seen in Gray Herbarium.

Agalinis oligophylla Pennell, in Bull. Torr. Bot. Club 40: 432. 1913. New name for *Gerardia plukenetii microphylla* A. Gray, not *A. microphylla* Raf., 1837.

Corolla rose-pink, with two yellow lines and, mostly along these, rather large purple-red spots within throat anteriorly. Flowering from late September to late October.

Sandy or somewhat clayey soil, long-leaf pineland, or more rarely prairies, southern Louisiana and southeastern Texas. Most abundant in the flat long-leaf pineland of southwestern Louisiana and southeastern Texas, less frequent or occasional on the adjacent coastal prairie. Ranges eastward to southern Mississippi.

LOUISIANA. Calcasieu: Lake Charles, Pennell 5617 (A, C, H, J, K, L, M, P, U, Y). Rapides: Glenmora, Pennell 5630 (A, C, H,

I, J, L, M, N, P, U, Y); Pineville, Pennell 5640 (A, C, H, P, S), 5647 (K, M, P, U, Y).

TEXAS. Hardin: Silsbee, Pennell 5591 (M, N, P, U). Harris: Harrisburg, Pennell 5576 (A, C, H, J, K, L, M, P, S, T, U, Y). Jasper: Buna, Pennell 5583 (A, C, H, L, N, P, S, Y). Orange: Orange, Pennell 5607 (P).

11. *Agalinis gattingeri* (Small) Small.

Gerardia tenuifolia leptophylla Benth., in Compan. Bot. Mag. 1: 174. 1836. "Jacksonville, Louisiana. Drummond." Type seen in Kew Herbarium. *Gerardia gattingeri* Small, Fl. S. E. Un. St. 1078, 1338. 1903. "Type, Curtiss N. A. Pl. no. 1910* in Herb. C. U." Type, collected by A. Gattinger on hills around Nashville, Tennessee, seen in Herb. Columbia University. *Agalinis gattingeri* (Small) Small, in Britton & Brown, Ill. Fl. N. Un. St. and Can. ed II. 3: 213. 1913.

Corolla pink, with two yellow lines and several to many rather large purple-red spots within throat anteriorly. Flowering from late August to mid-October.

Sandy or clayey soil, often stony, woodland, barrens or open bluffs; in the Ozark and Ouachita mountains of Arkansas and southeastern Oklahoma; in hills of east-central Oklahoma; in the oak and short-leaf pineland of northwestern Louisiana and eastern Texas, extending nearly to coast in Harris County, Texas. Ranges from Michigan and Minnesota, south to Alabama and Texas.

ARKANSAS. Boone: Harrison, E. J. Palmer 6913 (M). Carroll: Eureka Springs, E. J. Palmer 4561 (P). Garland: Hot Springs, Pennell 5681 (P). Hempstead: Fulton, E. J. Palmer 6870 (M). Newton: Jasper, E. J. Palmer 6945 (M). Pulaski: Little Rock, Hasse (Y).

OKLAHOMA. Creek: Sapulpa, Bush 443 (M, N, U, Y). Le Flore: Canaval Mt., E. J. Palmer 9057 (M).

LOUISIANA. Caddo: Shreveport, Pennell 5656 (P, U), 5659 (C, M, N, P, Y), 5666 (A, H, I, L, P, U). Rapides: Alexandria, Hale (A, U, Y). Sabine: Sodus, Pennell 5650 (A, J, K, L, M, P, S, T, Y), 5652 (C, H, N, P, U).

TEXAS. Harris: Lynchburg, Lindheimer (M). Lamar: Paris, Heller 4219 (M, U, Y). Panola: Beckville, Reverchon 3225 (M). Polk: Livingston, E. J. Palmer 6796 (M).

12. *Agalinis viridis* (Small) Pennell, comb. nov.

Gerardia viridis Small, in Bull. Torr. Bot. Club 25: 619. 1898. "Mr. Heller . . . collected . . . specimens . . . about Texarkana, Arkansas, during the past season, no. 4240." Type seen in Herb. New York Botanical Garden.

Corolla pale-pink, with two yellow lines and faint purple-red

spots within throat anteriorly. Flowering from early September to early October.

Moist sandy pineland in the Coastal Plain; frequent or common in long-leaf pineland, rarely on coastal prairies, in southwestern Louisiana and southeastern Texas; frequent or occasional in short-leaf pineland, of northwestern Louisiana and northeastern Texas, extending through eastern Arkansas to southeastern Missouri; also on prairies of southwestern Missouri.

ARKANSAS. Jefferson: Pine Bluff, Pennell 5184 (A, C, H, J, M, P, U, Y).

LOUISIANA. Boissier: Alden Bridge, Trelease (M). Caddo: Shreveport, Pennell 5668 (A, H, L, M, P). Calcasieu: Kinder, Pennell 5625 (C, P, Y); Lake Charles, Pennell 5620 (P, S, U). Rapides: Glenmora, Pennell 5633 (A, H, L, M, N, P, U); Pineville, Pennell 5642 (P, U), 5649 (C, P, U, Y). St. Landry: Eunice, Langlois (N).

TEXAS. Bowie: Texarkana, Heller 4240 (A, C, H, I, M, U, Y). Brazoria: Columbia, Bush 1532 (M, Y). Hardin: Silsbee, Pennell 5592 (C, H, K, N, P). Harris: Harrisburg, Pennell 5577 (C, H, M, P, T, U, Y). Jasper: Buna, Pennell 5584 (A, I, J, L, P, U), 5589 (M, N, P, Y). Orange: Orange, Pennell 5606 (A, P, U).

13. *Agalinis edwardsiana* Pennell, sp. nov.

Annual. Plant dull-green or purplish, tending to blacken in drying. Stem 4-8 dm. tall, slender, with many laxly ascending-spreading branches, obscurely striate 4-angled above, nearly terete below, essentially glabrous (sparingly very minutely scabrellous near bases of branches). Leaves opposite or sparingly subopposite above, spreading, or the lower frequently somewhat reflexed, linear, entire, acuminate, those of the stem 2-3.5 cm. long, .5-.9 mm. wide; bracts gradually reduced; leaves scabro-roughened to nearly glabrous above. Axillary fascicles scarcely or not developed, when present much shorter than the subtending leaves. Racemes slightly elongated, frequently but one flower of pair developed, 2-9 flowered. Pedicels ascending-spreading, slender, filiform, glabrous, in flower 5-30 mm. long, in fruit 10-32 mm. long, 1.5 to 3 times the length of the bracts. Calyx-tube 3.5-4.5 mm. long, hemispheric, obscurely veined, rib-veined, $\frac{3}{5}$ - $\frac{2}{3}$ the length of the capsule, truncate, its lobes .1-.4 mm. long, triangular-subulate to subulate, acuminate; apex of tube and lobes within granular-puberulent. Corolla 20-23 mm. long, spreading 18-20 mm. wide, membranous; its tube 12-14 mm. long, straight; its lobes, posterior 5-6 mm. long, anterior 8-9 mm. long, all erose to emarginate, anterior spreading, posterior broadly arched over stamens and style; exter-

nally mostly glabrous, sparingly minutely pubescent below sinuses of lobes, within slightly pubescent about bases of filaments and in narrow line below posterior sinus; lobes all ciliate; rose-pink, 2 yellow lines and many small diffused sharply-defined red-purple spots within throat anteriorly. Filaments flattened, posterior 6 mm. long, anterior 9–10 mm. long, posterior lanose-pubescent near base, glabrous distally, becoming slightly lanose-pubescent toward apex, anterior lanose throughout; anther-cells 3–3.3 mm. long, lanceolate, cuspidate at base, scarcely muriculate, very densely lanose with white hairs on the valvular surface, glabrous on the sides. Style 13–15 mm. long, filiform-linear, pubescent to glabrous. Stigma 1–1.5 mm. long. Capsule, 6–7 mm. long, globose to obovoid-globose, dark-brown. Seeds 1.1–1.3 mm. long, broadly lunate-triangular to ovoid, narrower than broad, irregular, rounded; testa dark-brown to nearly black, with reticulations firm, nearly or quite black, enclosing broad, nearly hexagonal, angular, sunken spaces (honeycomb appearance); intrareticular lines not evident.

Type, dry adobe hills, 5 miles northeast of Boerne, Kendall County, Texas, collected in flower September 16, 1913, F. W. Pennell 5482; in Herb. University of Pennsylvania.

Thin soil over limestone, adobe soil, Edwards Plateau of Central Texas. Flowering in September.

TEXAS. Bexar: Comanche Spring, Lindheimer 149 (A, C, H, M, P, U, Y). Gillespie: Three Mill Creek, Jermy 754 p. p. (M, U); Williams Creek. Kendall: Boerne, Pennell 5482 (A, C, H, J, K, L, M, P, S, U, Y), 10417 (Y). Kerr: Kerrville, Pennell 10369 (A, C, T, U, Y). Travis: Austin, Pennell 10454 (H, M, P, Y), Tharp (T).

13a. *Agalinis edwardsiana glabra* Pennell, var. nov.

Stricter, Calyx-lobes .6–1 mm. long, triangular to triangular-acuminate. Mature capsule not seen. Otherwise as in the species.

Type, arroyos, Devils River, Texas, collected in flower, C. C. Parry (Mexican Boundary Survey 784); in United States National Herbarium.

Arroyos, western Edwards Plateau, Texas.

TEXAS. Valverde: Devils River, Parry (Mex. Bound. Surv. 784), (H, U).

14. *Agalinis tenuifolia* (Vahl) Raf.

Gerardia tenuifolia Vahl, Symb. Bot. 3: 7. 1794. "Habitat in America septentrionali." Type in Herb. Universitetets Botaniske Museum, Copenhagen, Denmark, collected by Von Rohren, and said to be probably from Philadelphia, is identified by Dr. C. H. Ostenfeld as agreeing with my number 2681 from Pennsylvania.

Agalinis tenuifolia (Vahl) Raf., New Fl. Am. 2: 64. 1837..

Corolla purplish-pink, with two yellow lines and small diffused purple-red spots within throat anteriorly.

The typical form, with small corollas and minute calyx-lobes, a plant widespread in the eastern United States and which passes into each of the following varieties, is scarcely or not represented in our area. Possibly the following collection should be assigned to it:

ARKANSAS. Miller: Texarkana, Pennell 5671 (P, U).

14a. *Agalinis tenuifolia leucanthera* (Raf.) Pennell.

Gerardia leucanthera Raf., Fl. Ludov. 50. 1817. Louisiana. C. C. Robin. No type known to exist.

Agalinis tenuifolia leucanthera (Raf.) Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 286. 1920.

Usually in moist soil, loam or clay, rarely in sand, woodland or meadow, especially near streams, in the Coastal Plain of Louisiana and eastern Texas. Ranges eastward through the Coastal Plain to southern Georgia and northern Florida. Eastward passes into the species.

LOUISIANA. Caddo: Shreveport, Pennell 5657 (P), 5660 (P, U), 5661 (A, H, K, L, M, P, Y), 5664 (C, J, P), 5669 (P, S). Calcasieu: Lake Charles, Pennell 5616 (C, H, L, P, U, Y); West Lake, Pennell 5612 (A, M, N, P, U) Concordia: —, Smith (H). Rapides: Alexandria, Hale (L, Y).

TEXAS. Bowie: Texarkana, Pennell 5673 (P), 5676 (P, T). Harrison: Marshall, E. J. Palmer 6860 (M). Orange: Orange, Pennell 5608 (P). Van Zandt: Grand Saline, Reverchon 2112 p. p. (M).

14b. *Agalinis tenuifolia macrophylla* (Benth.) Blake.

Gerardia tenuifolia macrophylla Benth., in Compan. Bot. Mag. 1: 174. 1836. "St. Louis, Jacksonville." T. Drummond. Fragment of type labeled "St. Louis," from Kew Herbarium, seen.

Gerardia besseyana Britton, in Mem. Torr. Bot. Club 5: 295. 1894. New name for *Gerardia tenuifolia macrophylla* Benth., not *G. macrophylla* (Nutt.) Benth.

Agalinis tenuifolia macrophylla (Benth.) Blake, in Rhodora 20: 71. 1918.

Moist to dry loam or clay soil, in deciduous woodland, usually along streams, in and near the Ozark and Ouachita hills, and the hills of east-central Oklahoma. Ranges from southern Ontario to Minnesota, south to northern Alabama and eastern Oklahoma. Eastward passes into the species and westward into the following variety.

ARKANSAS. Cleburne: Heber Springs, E. J. Palmer 6985 (M).

Hempstead: Fulton, Bush 1065 (M, U, Y). Nevada: Prescott, Hollister 65 (U). White: Bald Knob, Biltm. Herb. 477 (U).

OKLAHOMA. Cherokee: ———, Woodhouse (H). Creek: Sapulpa, Bush 421 (M).

14c. *Agalinis tenuifolia parviflora* (Nutt.) Pennell, comb. nov.

Gerardia tenuifolia parviflora Nutt., in Trans. Am. Phil. Soc. II. 5: 180. 1837. "In the prairies of the Arkansas above the Verdigris River." Oklahoma. T. Nuttall. Type, labeled "Ark.," seen in Herb. Academy of Natural Sciences of Philadelphia.

Moist soil, prairies near rivers, Great Plains of northern Oklahoma. Ranges from Michigan and North Dakota to Oklahoma and eastern Colorado. Eastward intergrades with the preceding variety.

OKLAHOMA. Alfalfa: Cherokee [Outlet], Carleton 439 (U). Wagoner (?): prairies above Verdigris River, Nuttall (A).

15. *Agalinis homalanthae* Pennell, sp. nov.

Gerardia longifolia Nutt., in Trans. Am. Phil. Soc. II. 5: 180. 1834. "Hab. on the banks of the Arkansas." T. Nuttall. Type seen in Herb. Academy of Natural Sciences of Philadelphia. Not *Agalinis longifolia* Raf., 1837.

Annual. Plant green or purplish, tending to blacken in drying. Stem 4–7 dm. tall, slender, with many ascending-spreading branches, scarcely striate-angled, slightly scabrellous. Leaves opposite, slightly subopposite above, spreading, linear, entire, acuminate, those of the stem 2.5–3 cm. long, 1–1.5 mm. wide; bracts gradually reduced; leaves somewhat scabrous above. Axillary fascicles strongly developed, shorter than the subtending leaves. Racemes elongated, frequently but one flower of pair developed, 4–10 flowered. Pedicels ascending-spreading, slender, filiform, slightly scabrellous, in flower 10–20 mm. long, in fruit reaching at least 20–27 mm. long, 1.5–2.5 times the length of the bracts. Calyx-tube 3–3.5 mm. long, broadly campanulate (in flower), scarcely rib-veined, truncate, its lobes 1–1.2 mm. long, lanceolate, acuminate; apex of tube and lobes within densely puberulent. Corolla 23–27 mm. long, spreading 21–25 mm. wide, membranous; its tube 15–18 mm. long, straight; its anterior lobes 8–9 mm long, posterior 3–4 mm. long, all slightly rounded to truncate, anterior spreading, posterior scarcely or not arched, flat-extended over stamens and style; externally pubescent, especially distally, within slightly pubescent about bases of filaments, pubescent in line below posterior sinus; lobes all conspicuously ciliate; rose-pink, 2 yellow lines and many small diffused purple-red spots within throat anteriorly. Filaments flattened, posterior 5–6 mm. long, anterior 7–8 mm. long, all lanose, very densely so toward apex; anther-cells 3–3.5 mm. long, lanceolate, cuspidate at base, very densely lanose with tortuous white hairs on the valvular surface, glabrous on the sides. Style 12–14 mm. long,

filiform-linear, slightly pubescent. Stigma 1.5–2 mm. long. Capsule not seen.

Type, sandy oakwoods, along San Antonio and Arkansas Railroad, about one mile west of Sheridan, Colorado County, Texas, collected in flower September 21, 1913, F. W. Pennell 5522; in Herb. University of Pennsylvania.

Sandy soil, post oak-woods, Fayette zone of central southeastern Texas, northward in cross-timbers to the hills of southern Oklahoma and the Arkansas River, certainly rare or local. Flowering in September.

OKLAHOMA. Johnston: Tishomingo, E. J. Palmer 6494 (M). —: Arkansas River, Nuttall (A).

TEXAS. Austin: San Felipe, Drummond 217 (H, Y). Colorado: Sheridan, Pennell 5522 (C, H, L, M, P, U, Y). Dallas: Oak Cliff, Reverchon (M). Harris: Houston, Hall (M). Waller: Hempstead, Hall (I) [differs by calyx-lobes apparently abnormally long, 5–6 mm. long].

26. **OTOPHYLLA**⁹ Benth.

Otophylla Benth., in DC. Prod. 10: 512. 1846.

Type species, *Gerardia auriculata* Michx.

Leaf-blades lanceolate to broadly lanceolate, upper auricled at base; scabrous above. Spikes little crowded. Calyx-tube over one-half capsule length, retrorse-pubescent. Corolla 20–23 mm. long. Style pubescent. Capsule 10–13 mm. long, broadly ovate. Seeds slightly angled. *O. auriculata*.

Leaf-blades bipinnatifid, segments linear or nearly so; nearly glabrous above. Spikes densely crowded. Calyx-tube less than one-half capsule length, minutely scabrellous to glabrate. Corolla 23–32 mm. long. Style glabrous. Capsule 8–10 mm. long, ovate-oblong. Seeds sharply angled. *O. densiflora*.

1. **Otophylla auriculata** (Michx.) Small.

Gerardia auriculata Michx., Fl. Bor. Am. 2: 20. 1803. "In pratis regionis Illinoensis [A. Michaux.]" Type not verified, but description distinctive. *Otophylla auriculata* (Michx.) Small, Fl. S. E. Un. St. 1075, 1338. 1903.

Corolla rose-pink, with many rather small purple-red spots within throat anteriorly. Flowering in August and September.

Moist to dry prairies, old fields, apparently native from Michigan to southern Minnesota and northwestern Arkansas; introduced in the northeastern states, but whether introduced or native in northeastern Texas is uncertain.

⁹ For discussion of generic name see Bull. Torr. Bot. Club 40: 126. 1913, and Torreya 19: 215–16. 1919.

ARKANSAS. "N. W. Ark.," Harvey 11 (H).

TEXAS. Tarrant: Benbrook, Reverchon 3937 (M, Y).

2. *Otophylla densiflora* (Benth.) Small.

Gerardia densiflora Benth., in Compan. Bot. Mag. 1: 206. 1837. "Texas. Drummond." Isotype, Drummond 218, seen in Herb. Columbia University.

Otophylla densiflora (Benth.) Small, Fl. S. E. Un. St. 1075, 1338. 1903.

Dry sterile or stony prairies and bluffs, especially calcareous, central Oklahoma south to the hills of central Texas (eastern Edwards Plateau). Ranges northward to central Kansas. Flowering in August and early September.

OKLAHOMA. Alfalfa: Cherokee [Outlet], Carleton 470 (I, U). Cleveland: —, P. J. White (R). Logan: —, Carleton 728 (O, R). Payne: —, Olive 142 (Y).

TEXAS. Bexar: Comanche Spring, Lindheimer 112 (A, C, H, M, P, U, Y). Blanco: Blanco, — (M). Comal: New Braunfels, Lindheimer 379 (A, C, H, M, P, U, Y). Dallas: Dallas, Reverchon 1198 (C, M, P, U). Hood: Granbury, E. J. Palmer 6556 (M).

27. *BUCHNERA* Linné.

Buchnera L., Sp. Pl. 630. 1753.

Type species, *B. americana* L.

Leaves 3-9 cm. long, lanceolate to ovate-lanceolate, relatively coarsely dentate. Corolla-lobes 6-9 mm. long, the tube 2-2½ times the length of the calyx. Capsule 8-9 mm. long, oblong. Stem hirsute-pubescent.

1. *B. americana*.

Leaves 2-7 cm. long, prevailing lanceolate-elliptic, mostly obtuse, entire or the lower slightly dentate. Corolla-lobes usually 4-6 mm. long, the tube mostly 1-1½ times the length of the calyx. Capsule 5-6.5 mm. long, ovate. Stem less pubescent or even glabrate.

2. *B. elongata obtusa*.

1. *Buchnera americana* L.

Buchnera americana L. l. c. 630. 1753. "Habitat in Virginia, Canada." Based upon Gron., Fl. Virg. 74. 1743, typified by Clayton 142 from Virginia. Description sufficiently distinctive.

Corolla purplish-blue throughout. Flowering from June to September, and soon ripening fruit.

Sandy or loam soil, prairies and barren knolls or open woodland of western Arkansas and eastern and central Oklahoma; southward into the Coastal Plain of Louisiana and eastern Texas (where leaves are smaller and more entire, and the plant probably intergrades with *B. elongata obtusa* Pennell). Ranges from Pennsylvania to southern Ontario and Illinois, south to Florida and Texas.

ARKANSAS. Sebastian: Fort Smith, Bigelow (U, Y).

OKLAHOMA. Alfalfa: Cherokee [Outlet], Carleton 477 (U).
Bryon: Colberts, Sheldon (Y). Caddo (?): ———, E. Palmer
221 (U, Y). Payne: Ingalls, Waugh 18 (U).

LOUISIANA. ———, Hale (Y).

TEXAS. Jasper: Buna, Pennell 5587 (P).

2. *Buchnera elongata obtusa* Pennell.

Buchnera elongata obtusa Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 288,
1920. "Type, open sandy pineland, 1-2 miles north of Abita Springs,
St. Tammany Parish, Louisiana, collected in flower and fruit August 14,
1912, F. W. Pennell 4190, in Herb. New York Botanical Garden."

Corolla purplish-blue or violet-purplish throughout. Flowering
from May to October, and soon ripening fruit.

Sandy soil, long-leaf pineland and adjacent coastal prairie of
southern Louisiana and southeastern Texas; westward to oak-woods
of Colorado county, Texas. Ranges eastward in the Coastal Plain
to North Carolina.

LOUISIANA. Calcasieu: Lake Charles, Allison 251 (U, Y).
Jeff Davis: Jennings, Pennell 10207 (L, M, Y). Rapides: Alexan-
dria, Hale (Y).

TEXAS. Colorado: Sheridan, Pennell 5521 (P, Y). Hardin:
Silsbee, Pennell 5590 (P, Y). Waller: Hempstead, Hall 417 (U, Y).
Wichita: Burkburnett, Tharp 604 (Y).

28. *SCHWALBEA* Linné.

Schwalbea L., Sp. Pl. 606. 1753.

Type species, *S. americana* L., of Virginia.

1. *Schwalbea australis* Pennell.

Schwalbea australis Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 289. 1920.
"Type, damp pine barrens near Seville, Volusia County, Florida, collect-
ed in flower May 10, 1900, A. H. Curtiss 6742; in Herb. New York Botani-
cal Garden."

Sandy soil, rather moist, oakland and pineland, in central
Louisiana. Ranges through the Coastal Plain from South Carolina
to central Florida and Louisiana. Flowering in May.

LOUISIANA. Rapides: Alexandria, Hale (Y), Cocks (L).

29. *CASTILLEJA* Mutis.

Castilleja Mutis; L. f., Suppl. 293. 1781.

Type species, *C. fissifolia* L. f., of Colombia.

Root perennial. Sepals not expanding distally. Seeds with
heavier reticulations enclosing relatively hexagonal areas.
Stems white-tomentose or -lanate.

Sepals of each side distally free. Posterior lobes of corolla with narrow membranous margins, anterior lobes relatively developed (over one third length of posterior) and distally thin. Leaf-blades pinnatifid-lobed, and like the calyx more or less pubescent.

Corolla 40-50 mm. long. Sepals attenuate, acutish to acute.

Capsule 15 mm. long. Stem tomentose. Bracts and calyx distally yellowish.

1. *C. sessiliflora*.

Corolla shorter. Sepals broader. Capsule 10-13 mm. long. Stem appressed-lanate.

Corolla 35-40 mm. long, its anterior lobes 5-7 mm. long, yellow and much longer than the slightly thickened green base. Sepals acute to acuminate. Stigma about 1 mm. wide. Leaves 3-7 cm. long. Bracts and calyx yellowish.

2. *C. labiata*.

Corolla 30-35 mm. long. Seeds 1.5-1.8 mm. long, brown. Leaves 5-8 cm. long.

Anterior corolla-lobes 5-7 mm. long, purple, evidently longer than the thickened green base. Sepals acutish or acute. Bracts and calyx distally violet-purple. Stigma nearly 1 mm. wide.

3. *C. purpurea*.

Anterior corolla-lobes 3-4 mm. long, pinkish, little if at all longer than the thickened green base. Sepals obtuse. Bracts and calyx distally orange-red. Stigma about .5-.7 mm. wide.

4. *C. lindheimeri*.

Corolla 18-23 mm. long. Seeds 1.2 mm. long, blackish-brown. Leaves 3-6 cm. long. Bracts and calyx distally lemon-yellow.

5. *C. citrina*.

Sepals of each side united throughout, broadly rounded. Posterior lobes of corolla with broad membranous margins, anterior lobes green, thickened nearly throughout, and less than one fourth length of posterior. Leaf-blades entire.

Stems, leaves and calyces densely white-lanate. Leaves linear; the bracts usually trifid.

6. *C. lanata*.

Stem, leaves and calyces finely pubescent, green. Leaves oblong-lanceolate; the bracts broad, entire.

7. *C. latebracteata*.

Root annual. Sepals of each side united throughout, expanding distally to the broadly rounded apex. Seeds with lighter pale-brown reticulations enclosing slightly elongated areas. Bracts and calyx distally red. Stem loosely pubescent.

Anterior corolla-lobes developed, distally thin, yellowish. Leaf-blades pinnatifid-lobed. Plant forming a flat basal rosette of leaves, which persist until after anthesis.

8. *C. coccinea*.

Anterior corolla-lobes very short, thickened, green. Leaf-blades entire or occasionally slightly pinnatifid-lobed. Basal rosettes less definitely formed, not persisting.

9. *C. indivisa*.

1. *Castilleja sessiliflora* Pursh.

Castilleja sessiliflora Pursh, Fl. Am. Sept. 738. 1814. "In upper Louisiana. Bradbury. . . . v.s. in Herb. Bradbury." Imperfectly described. Better characterized by Nuttall, who knew the plant growing, as *Euchroma grandiflora*, Gen. N. Am. Pl. 2: 55. 1818.

Corolla yellowish-green, the posterior lip pink-margined, the anterior yellowish-white and only slightly greenish-thickened at base. Bracts and calyx distinctly yellowish. Flowering in May and June.

Sandy or rocky plains and bluffs, escarpments of the Staked Plains of northwestern Texas; Upper Sonoran Zone (at altitudes above 1500 meters). Through the Great Plains from Illinois and Manitoba to Wyoming and northwestern Texas.

TEXAS. Hall: Estelline, Reverchon 4316 (M, U, Y). Randall: Canyon, Pennell 10542 (A, H, M, O, T, U, Y).

2. *Castilleja labiata* Pennell, sp. nov.

Root perennial. Stems several, 1.5–2 dm. tall, arachnoid-lanate with close pubescence. Leaves 3–7 cm. long, linear to lanceolate, slightly 3-ribbed, trifid, with narrow lobes, finely cinereous-pubescent especially on the lower surface, green above, paler beneath. Bracts broader, conspicuously trifid, probably distally yellowish or greenish-yellow. Sepals 22–25 mm. long, those of each side united $\frac{2}{3}$ length, acutish to acuminate, puberulent, apparently yellowish. Corolla 35–40 mm. long; posterior lip 10–12 mm. long, with thin margins; anterior 5–7 mm. long, proximally deep-green, distally flaring, evidently yellow or yellowish; anterior lobes glandular-pubescent, posterior with longer glandless hairs. Stigma about 1 mm. wide. Capsule not seen.

Type, stony prairie (uncommon), San Angelo, Texas, collected in flower May 19, 1899, W. L. Bray 353, in United States National Herbarium; isotype in Herb. University of Texas.

I regret that the spring of 1920 had been so dry, and consequently so early, that on my visit to San Angelo on May 18 and 19, all *Castillejas* were in fruit and shriveled. I failed to find this species, but the plant I did find and which appeared to be common proved to be *C. citrina*, below. Though disliking to base a species of this critical genus on so few collections, I think *C. labiata* must be recognized. It appears to be a primitive member of the alliance of *C. purpurea* (Nutt.) G. Don, connecting that group with *C. sessiliflora* Pursh.

TEXAS. Tom Green: San Angelo, Bray 353 (T, U). Valverde: Devil's River, Pilsbry (A).

3. *Castilleja purpurea* (Nutt.) G. Don.

Euchroma purpurea Nutt., in Trans. Am. Phil. Soc. II. 5: 180. 1837.
 "Hab. On rocks in the hilly prairies of Red River [Arkansas Territory.
 T. Nuttall]" Type seen in Herb. Academy of Natural Sciences of Philadelphia.

Castilleja purpurea (Nutt.) G. Don, Gen. Hist. 4: 615. 1838.

Rocky prairies and bluffs, especially calcareous, in the Grand and Black Prairies and adjacent hills, southeastern Oklahoma and north-eastern Texas; also in the prairies of the Verdigris River in north-eastern Oklahoma. Flowering in April and May, and soon ripening fruit.

OKLAHOMA. Atoka: Limestone Gap, G. D. Butler 30 (U).
 McCurtain: Idabel, Houghton 3681 (M). Rogers: Catoosa, Bush 1048 (M, Y).

TEXAS. Dallas: Dallas, Reverchon 714 (M, P, U). Hood: Granbury, Eggert (M, U, Y). Tarrant: Texas Christian Univ., Ruth 371 (U, Y).

4. *Castilleja lindheimeri* A. Gray.

Castilleja lindheimeri A. Gray, Syn. Fl. N. Am. 2. 1: 298. 1878. "Stony or fertile mountain prairies, on the Piedernales and Guadalupe, W. Texas. Lindheimer, &c." Type not seen, but description distinctive.

Corolla whitish-green, the posterior lip with orange-red margin, the anterior pinkish-red and green-thickened at base. Bracts and calyx distally orange-red. Flowering in April and May, and soon ripening fruit.

Gravelly or rocky calcareous soil, prairies or hills, from Parker and Tom Green (or Martin) to Hays and Uvalde counties, Texas. Common on the hills of the Edwards Plateau, on the Lampasas Plain and in the Coleman and Concho districts, Lower Sonoran Zone (at altitudes of 500 to 2,000 feet).

TEXAS. Bexar: Camp Stanley Inc., Pennell 10414 (T, Y). Blanco: Blanco, E. J. Palmer 13290 (M). Coleman: Coleman, Reverchon 117 (M). Comal: Fischer Store, E. J. Palmer 12189 (M). Comanche: Comanche, Eggert (M). Gillespie: Nibo Mt., Jermy 279 (M, U). Hays: San Marcos, Pennell 10431 (A, C, H, K, M, T, U, Y). Hood: Granbury, Eggert (M). Kendall: Boerne, Pennell 10421 (P, Y). Kerr: Kerrville, Heller 1630 (A, M, U, Y), Pennell 10364 (A, H, L, M, T, Y), 10396 (J, O, S, U, Y); Laceys Ranch; Turtle Creek. [? Martin:¹⁰ Stanton, Eggert (M).]

¹⁰ Martin: Stanton (prairies n.) H. Eggert, collected in flower and fruit June 13, 1900 (M).

Plant 3.5 dm. tall, in fruit and late flower. Faded and with broken short

Medina: Hondo, Pilsbry (A). Menard: Menard, E. J. Palmer 11876 (bracts yellow) (M). Parker: —, N — (M, U). Tom Green: San Angelo, Reverchon 3932 (M, U). Travis: Austin, Pennell 10437 (U, Y).

5. *Castilleja citrina* Pennell, sp. nov.

Root perennial. Stems several, 1-3 dm. tall, arachnoid-lanate with close pubescence. Leaves 3-6 cm. long, narrow, 3-ribbed, trifid, with narrow falcate lobes loosely or finely cinereous-pubescent, pale. Bracts broader, conspicuously trifid, distally lemon-yellow. Sepals 18-20 mm. long, those of each side united less than one third length, all obtuse, puberulent, distally lemon-yellow. Corolla 18-23 mm. long; posterior lip 9-10 mm. long, deep-green with pale-yellow thin margins; anterior 3-4 mm. long, proximally deep-green, distally flaring, pale-yellow; all lobes glandular-pubescent, the posterior with longer hairs. Stigma about .7 mm. wide. Capsule 10-12 mm. long, ovoid in outline, brown. Seeds about 1.2-1.5 long, oblong, alveolate-reticulate, dark-brown or blackish.

Type, stony limestone knoll, Talpa, Coleman County, Texas, collected in flower and fruit May 20, 1920, F. W. Pennell 10516; in Herb. New York Botanical Garden.

Rocky calcareous bluffs and prairies or low hills, prairies of western Oklahoma, south to Coleman and Concho regions of central Texas; lower Sonoran Zone (at altitudes of 1,400 to 2,400 feet). Flowering in May and soon ripening fruit.

OKLAHOMA. [Beckham: Doxey, observed by Pennell]. Woods: Waynoka, Stevens (M, U); Whitehorse.

TEXAS. Callahan: Baird, E. J. Palmer 13695 (M). Coleman: Talpa, Pennell 10516 (A, H, K, M, O, T, U, Y). Howard: Big Spring, Eggert (M). Tom Green: San Angelo, Pennell 10501 (C, J, Y), 10508 (A, H, L, M, T, U, Y).

6. *Castilleja lanata* A. Gray.

Castilleja lanata A. Gray, in Torr., Bot. Mex. Bound. 118. 1859. "Along and near the Rio Grande, from Eagle Pass, etc., to El Paso; Wright (452, 1495), Bigelow, Parry, etc." Cotype, Wright 1495, seen in Herb. Columbia University at the New York Botanical Garden.

Bracts and sepals distally red. Flowering in late March and April.

leaves. Few fruits developed. Capsule 12-14 mm. long, probably not normal. No seeds seen. Inflorescence nearly whole height of plant. Sepals 20 mm. long, lateral narrowing, acutish. Corolla 25-30 mm. long, narrow, galea 8-10 mm. long, lip 3 mm. long, thin, distal portion as long as the thickened green basal portion.

From a different formation west of the range of *C. lindheimeri* A. Gray, but material insufficient for positive identification.

Arid valleys, near the Rio Grande in Valverde County, Texas. Extends westward through Trans-Pecos Texas; Lower Sonoran zone.

TEXAS. Valverde: Del Rio, Hanson 377 (Y), E. J. Palmer 11353 (M), Pilsbry (A).

7. *Castilleja latebracteata* Pennell, sp. nov.

Root perennial. Stems several or many, 2-4 dm. tall, finely pubescent or above bearing longer hairs, some hairs gland-tipped. Leaves 6-7 cm. long, oblong-oblongate, 3-nerved, entire, roughish-puberulent or -pubescent. Bracts oblong or nearly obtriangular, broadly rounded, sometimes as wide as long, distally violet-red. Sepals 22-24 mm. long, those of each side united to apex, truncate-rounded, pubescent, distally violet-red. Corolla 25-27 mm. long; posterior lip 11-12 mm. long, pubescent dorsally, with broad thin margin; anterior about 1 mm. long, incurved. Stigma .5-.7 mm. wide. Capsule at least 11 mm. long.

Type, High Bridge of the Pecos, Valverde Co., Texas, collected in flower April 27-28, 1903, Dr. H. A. Pilsbry; in Herb. Academy of Natural Sciences of Philadelphia; isotype in Herb. New York Botanical Garden.

Nearly related to *C. nervata* Eastw., and *C. rigida* Eastw., both from Chihuahua. From both it differs in its wide leaves and lesser amount of pubescence; also from the former in larger flowers and lack of prominence of the lateral nerves or ribs of the leaf.

Flowering in late April.

Arid valleys, near the Rio Grande in Valverde County, Texas. Lower Sonoran Zone. Known only from original collection.

8. *Castilleja coccinea* (L.) Spreng.

Bartsia coccinea L., Sp. Pl. 602. 1753. "Habitat in Virginia, Noveboraco"

Type, Clayton 293, is certainly the plant here considered.

Castilleja coccinea (L.) Spreng., Syst. Veg. 2: 775. 1825.

Corolla yellowish-green, posterior lip yellowish-margined, the anterior yellowish-white with thickened green base. Bracts and sepals distally scarlet-red. Flowering from March to May.

Moist sandy meadows and glades, northwestern Arkansas; in Coastal Plain in moist pineland of Central Louisiana and on coast prairies of southwestern Louisiana. To be expected through intervening areas. Ranges from Maine to Manitoba and Kansas, south to Georgia and Louisiana.

ARKANSAS. Benton: —, Harvey 60 (M). Carroll: Beaver, E. J. Palmer 5590 (M).

LOUISIANA. Calcasieu: Lake Charles, Cocks (L); Welsh, E. J.

Palmer 7656 (M) [Leaves entire or nearly so, apparently approaching *C. indivisa* Engelm.]. Rapides: Alexandria, Hale (L).

9. *Castilleja indivisa* Engelm.

Castilleja indivisa Engelm., in Boston Journ. Nat. Hist. 5: 255. 1845.
 "284 . . . Prairies from Houston to the Colorado [Texas, Lindheimer]".
 Isotype, Lindheimer, Fasc. II., 284, collected in 1844, seen in Herb. Academy Natural Sciences of Philadelphia.

Corolla greenish, the posterior lip with yellowish thin margins and the anterior conspicuously thickened and green. Bracts and sepals distally red. Flowering from March to April and soon ripening fruit.

Sandy loam, prairies, through the Coastal Plain of middle Texas, from Hunt to Harris, Bexar and Kleburg counties. Common on the coast prairie of mid-coastal Texas, inland west of the pine belt to the black belt; Austroriparian Zone (at altitudes under 700 feet).

TEXAS. Austin: Kenney, Pennell 10312 (P, Y); San Felipe, Pennell 10291 (M, Y); Wallis, Pennell 10286 (A, C, H, J, K, L O, S, T, U, Y). Bexar: San Antonio, Blake (Y). Brazoria: Columbia, Bush 74 (M, U, Y). Brazos: Bryan, E. J. Palmer 7787 (M); College Station. Colorado: Eagle Lake, E. J. Palmer 4929 (M). Comal: New Braunfels, Lindheimer (M). Dallas: Dallas, Reverchon (A, M, P, U, Y). Dewitt: Cuero, Howell 297 (U). Fort Bend: Richmond, Bray 109 (T, U); Rosenberg. Harris: Houston, Hall 422 (M, U, Y), Pennell 10253 (Y); Hockley. Hunt: Commerce, Warren 124 (M). Jackson: Ganado, E. J. Palmer 9222 (M). Kaufman: Terrell, Reverchon (M). Kleburg: Kingsville, High 74 (M). McLennan: Waco, Ricker 3362 (U). Navarro: Corsicana, Reverchon 3222 (M). Robertson: Calvert, Merrill 27 (Y). Victoria: Victoria, Tracy 9165 (M, P, T, U, Y). Wharton: Hungerford, E. J. Palmer 4848 (M).

30. **PEDICULARIS** Linné.

Pedicularis L., Sp. Pl. 607. 1753.

Type species, *P. palustris* L., of Europe.

1. *Pedicularis canadensis* L.

Pedicularis canadensis L., Mant. 86. 1767. "Habitat in America septentrionali. Kalm." Description distinctive.

Corolla light-yellow throughout (not showing the purple frequently developed in northern plants of this species). (Cf. Nuttall, in Trans. Am. Phil. Soc. 5: 179. 1834.) Flowering in April, and soon ripening fruit.

Sandy soil, oak-knolls in long-leaf pineland, and on adjacent coast prairie, western Louisiana and eastern Texas. Ranges from Nova Scotia to Manitoba, south to Florida and Texas.

LOUISIANA. Calsasieu: DeQuincy, Pennell 10230 (A, C, H, U, Y); Perkins, Pennell 10212 (H, K, L, M, T, U, Y); Lake Charles, Cocks (L); Vinton. Natchitoches: Natchitoches, Cocks (L).

TEXAS. Jasper (?): 30 miles northeast of Beaumont, Bray 67 (T, U). San Augustine: San Augustine, Crocket (U).

HERBARIA IN WHICH SPECIMENS SEEN MAY BE CONSULTED.

Guide-letters in the list of specimens cited with each species refer to the following herbaria.

- A—Academy of Natural Sciences, Philadelphia, Pa.
- C—Field Museum of Natural History, Chicago, Ill.
- H—Gray Herbarium of Harvard University, Cambridge, Mass.
- I—University of Illinois, Urbana, Ill.
- J—Jardin des Plantes, Paris, France
- K—Kew Gardens, Kew, England
- L—Tulane University, New Orleans, La.
- M—Missouri Botanic Garden, St. Louis, Mo.
- N—University of Notre Dame, Notre Dame, Ind.
- O—Agricultural Experiment Station, Stillwater, Okla.
- P—University of Pennsylvania, Philadelphia, Pa.
- R—University of Wyoming, Laramie, Wyo.
- S—Charleston Museum, Charleston, S. C.
- T—University of Texas, Austin, Tex.
- U—United States National Herbarium, Washington, D. C.
- Y—New York Botanical Garden, Bronx Park, New York City

COLLECTORS WHOSE SPECIMENS ARE CITED IN LISTS ACCOMPANYING SPECIES.

Letters, following each name, denote state from which collector's specimens have been seen: A—Arkansas, L—Louisiana, O—Oklahoma, T—Texas.

Allison, Andrew (L).
 Ball, C. R. (L).
 Barker, C. (O).
 Berlandier, J. L. (T).
 Bigelow, J. M. (A, O, T).
 Biltmore Herbarium (A).
 Blake, W. P. (T).
 Blankinship, J. W. (O).
 Blankinship, L. A. (O).
 Bray, W. L. (T).
 Broadhead, G. C. (T).
 Buckley, S. B. (T).
 Bush, B. F. (A, L, O, T).

Butler, G. D. (O).
 Butler, Mrs. J. (T).
 Canby, W. M. (T).
 Carleton, M. A. (O).
 Chandler, H. P. (T).
 Clawson, A. B. (T).
 Clemens, J. (T).
 Cocks, R. S. (L).
 Coville, F. V. (A).
 Crawford, E. W. (T).
 Crocket, G. L. (T).
 Croft, M. B. (T).
 Dewey, L. H. (T).

Diffenderfer, W. L. (T)¹¹
 Dixon, R. A. (T).
 Drummond, Thomas (L, T).
 Eggert, Henry (A, O, T).
 Emig, W. H. (O).
 Engelmann, George (A).
 Fisher, G. L. (T).
 Foreman, Edward (A).
 Gregg, Josiah (L).
 Griffith, (T).
 Groth, B. H. A. (T).
 Hale, Josiah (L).
 Hall, Elihu (T).
 Hanson, H. C. (T).
 Harvey, F. L. (A).
 Hasse, H. E. (A).
 Havard, Valery (T).
 Hayes, Sutton (T).
 Heller, A. A. & E. G. (T).
 High, M. M. (T).
 Hildebrandt, A. M. (T).
 Hill, R. J. (T).
 Hogan, George (T).
 Hollister, M. P. (A).
 Holstein, G. W. (T).
 Houghton, H. W. (O).
 Howell, A. H. (A, T).
 Hunt, E. A. (A).
 Jermy, Gustav (T).
 Jermy, Julius (T).
 Joor, J. F. (L, T).
 Langlois, A. B. (L).
 Larrabee, R. N. (T).
 Lea, A. V. (T).
 Learn, C. D. (O).
 Leavenworth, M. C. (A, T).
 Letterman, G. W. (A, T).
 Lewton, F. L. (T).
 Lincecum, Gideon (T).
 Lindheimer, Ferdinand (T).
 Lloyd, F. E. (L).
 Mackensen, Bernard (T).
 Mackenzie, K. K. (L).
 Marcy, R. B. (O).
 Marlott, C. L. (T).
 Maxon, W. R. (T).
 McAtee, W. L. (A).
 McReynolds, A. B. (O).
 Merrill, F. J. H. (T).
 Mexican Boundary Survey
 (Parry, Bigelow, Wright & Schott).
 Meyer, Emanuel (T).
 Milligan, Mrs. J. M. (T).
 Moseley, E. L. (L).
 Myers, S. E. (O).
 Nash, Mrs. M. L. (T).
 Nealley, G. C. (T).
 Neaves, Clara (O).
 Nuttall, Thomas (O).
 Olive, E. W. (O).
 Oyster, J. H. (O).
 Pace, Lula (T).
 Palmer, Edward (O, T).
 Palmer, E. J. (A, L, O, T).
 Pammel, L. H. (T).
 Parry, C. C. (T).
 Peck, C. (L).
 Pennell F. W. (A, L, O, T).
 Pilsbry, H. A. (A, O, T).
 Pitcher, Zina (A).
 Plank, E. N. (A, L, T).
 Pringle, C. G. (T).
 Reverchon, Julien (T).
 Ricker, P. L. (T).
 Robin, C. C. (L)¹²
 Römer, (T).¹¹
 Rose, J. N. (T).
 Ruth, Albert (T).
 Schott, Arthur (T).
 Schulz, E. D. (T).
 Seaman, W. H. (T).
 Sheldon, C. S. (O).
 Shepherd, T. M. (T).
 Smith, J. D. (L).
 Stanfield, S. W. (T).
 Stevens, G. W. (O).
 Tharp, B. C. (T).
 Thurber, George (T).
 Thuron, F. W. (T).
 Tracy, S. M. (L, T).
 Trelease, William (L).
 Tweedy, Frank (T).
 Tyler, F. J. (T).
 Vinzent, (T).
 Ward, L. F. (O, T).
 Warren, W. H. (T).
 Waugh, F. A. (O).
 Wells, B. W. (A).
 White, M. J. (T).
 White, P. J. (O).
 Williamson, C. S. (A, T).
 Wolf, (T).
 Woodhouse, S. W. (O).
 Wright, Charles (T).
 Wurzlów, E. C. (L).
 Wurzlów, H. (T).
 York, H. H. (T).
 Young, M. S. (T).

¹¹ Collector of the type of a species from this area, but specimens not seen.

¹² Traveled in Louisiana and described many plants seen, but not known to have collected specimens.